605 V.10 1337

THE FOUNDRY

VOL. 10. DETROIT, MICH., MARCH, 1897. No. 55

Down Draft Core Oven—Underground Plan.

BY W. L. HAYDEN.

In the underground construction it is essential that care be taken to make the average area of square and spider flues exceed in such proportion the area of outlet flues to avoid all friction and insure a free and easy circulation. Ground plan (Fig. 6) gives the outline of flues, their relative position, etc. The crosshead (T) is the first part of our underground construction that will be taken up; a section of which can be viewed in Fig. 7. After necessary excavation one course of fire brick is all that is necessary for lin-

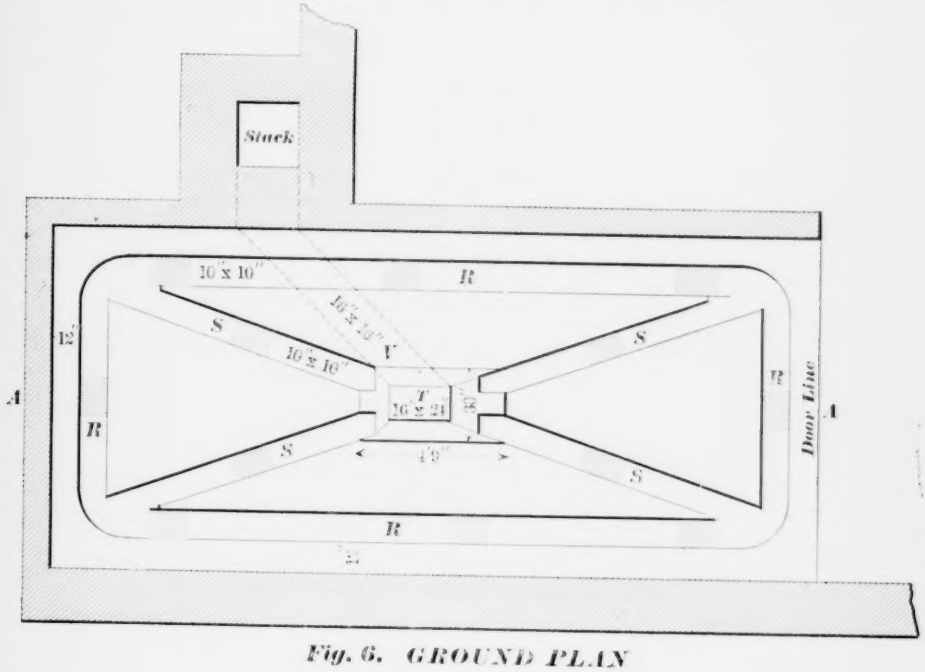


Fig. 6. GROUND PLAN

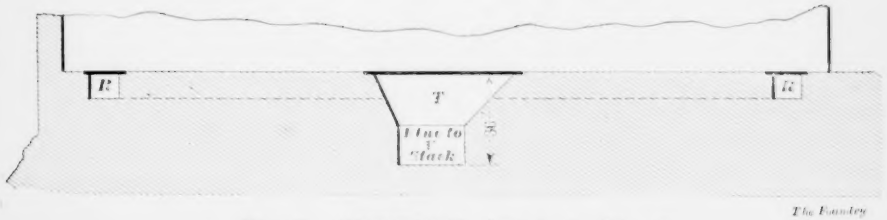


Fig. 7. SECTION AT A-A, Fig. 6.

Tech 55

ing, being laid carefully in cement or common mortar (the first preferable). Wall should be grouted well behind, so as to give a good contact with the solid earth thus making them more substantial. At the two ends of crosshead that slope in reducing the area at bottom, the brick can be racked to accommodate this shape or cemented solid, as preference may direct. The bottom of crosshead being in this case 16x24 inches, retaining this size the hight of outlet flue V, at which point it racks out lengthwise equally at both ends to 4 feet 9 inches in length, giving us an opening at top of 4 feet 9 inches by 2 feet 6 inches. At each top corner spider flues enter and the necessary holes should be left at these points. The crosshead can be built in several ways different from the above but this construction is usually carried out having proven itself to give better results and less trouble in the way of repairs. Having this part constructed and inlet hole located for connections, we have a center point to which we can direct the remaining work with accuracy and little trouble. The next excavation for outlet flue V is the deepest and most difficult of all, being necessary to go to the level of crosshead bottom, and from that point to wherever stack is located.

After getting the trench dug out we brick the bottom to a width of 25″ and then lay side walls to a hight of 16″ directly on bottom, which leaves an inside measurement of 16″ square. On the top of this flue lay slabs of cast iron, with a good bearing surface on each side, the entire length of flue. Cement connections and see that joints at crosshead and stack are tight and strong. With this precaution the dirt thrown in for refilling trench to floor level does not get into flue so as to obstruct it. Some persons think sewer pipe of requisite dimension are as good as a bricked flue. I agree on all points but one and that is, in case of it being necessary to get into flue for cleaning; a two-foot slab is much easier removed than a two-foot sewer pipe with socket cemented. Even if one length of sewer pipe has a manhole in it the room for action so far below the level of the ground, is not sufficient. The flue (R. R. R. R.) is built in ground so as to clear side walls about one foot and be about ten inches square, with top side on a level with floor. This is commonly called the square flue (or round flue in round kiln construction) and is, in my opinion the most important flue yet placed. This is the starting point of the downward circulation, which makes the process so valuable to those who wish a uniform heat at all points. The spider flues (S. S. S. S.) running diagonally are on the same level as square flue. They, by no means act only as tributaries to crosshead but functionate by increasing downward conduction. Their dimensions are the same as square flue, and all are bricked and slabed in the same manner described, for outlet flue. The only exception being that eight grates are placed at equal intervals on square flue, and four on spider flue (in place of solid slabs) which are sufficient openings for draft. The amount of suction directly over grates is surprising and by this suction the hot air and gas which take their upward start from fire bag to arch, being checked by its surface, are drawn down and diffused throughout the core oven.

When doors (X) are closed, as shown in last article and fire in only one chamber, the draft is just as good, although connected throughout. The hot air being absent in one chamber is supplied by cold air and the two unite in crosshead with the same efficiency it seems, as though the entire oven was in use. An important fact that should not be overlooked is that the main stack should be built of a sufficient hight to avoid all obstructions and give the oven the full benefit of its capacity.

The nearer it is located to oven the less expense and trouble in laying and connecting outlet flue. It is in place to mention that a vitrified brick, well glazed, will make a stack that will outlast a common red brick construction, two to one. It also resists moisture and preserves the bond; giving it better protection and longer life. I might say in case natural gas is used, instead of coke or coal, the stack and flues should be lined with fire-proof flue lining on inside of brick work. This protects the mortar from the dry heat of the gaseous fumes, which will in a short time thoroughly deprive the mortar of all existing strength and allow bricks to separate and become dislodged. With coke or coal we do not meet with this obstacle and the above is unnecessary.

(To be continued.)

Making Molders.

By HERBERT M. RAMP.

The Foundrymen's Associations and the trade journals of the day, have been devoting considerable time, space and attention, to the question of a correct and beneficial form of apprenticeship, and inquiring, "Why, our molders of to-day are not equal to the so-called class of twenty or forty years ago." It appears they have recently awakened to the fact, our business in its quality or excellence, as far as workmanship is concerned, has been depreciating for some time, and the knight of the rammer occupies a lower position, intellectually and mechanically, than he did of yore. Many suggestions and theories for making better molders have been forthcoming, and the employers appear to have taken the thing in hand, as a machine they expect to construct, that will grind out, according to a set formula, whatever class of mechanics that may be desired. But strange as it may appear, molders are born, not made, the same as the artist, the preacher, the machinist, or any other individual who makes a success in any line. Yes, born, not so much with a natural talent in any specified direction, not with an overflow of youthful genius we so often hear proud parents boast of in some progeny of theirs, but born with capabilities to learn, to receive instruction and profit by it, and to exert the same to his advancement.

The molder must possess within himself the ability to become a good mechanic, or all the instructions and petty incentives in the universe will not induce him to rise in his profession. He must be a man desirous of excelling, for the sake of excellence and his future. Financial stimulants may induce a man to extra or unusual exertions for a stated time, but the apprentice who enters a shop with no end in view but the amount of pay he will be able to procure for his exertions, will seldom, if ever, mount very high on the ladder of good workmanship.

A few rules, a combination of employers, a small financial bonus, will not change the trend of a man's disposition; it may slightly alter or improve it, but it will never go deep enough to alter the man or boy's nature, be he slothful, negligent or careless. The boy that comes into the foundry, rough and uneducated, may succeed; the college graduate may succeed, but neither will do so through want of or superior education; it is the practical ability, the energy, the judgment with which they attack their surroundings, that by adoption becomes part of their life and expectations. The foundry has received apprentices of all types, from the best educated to the most ignorant, but the question of superior workmanship was never confined to the educated class, some of the most ignorant have become famous, and college graduates mere sash-weight molders. This is not said with the assumption that education is superfluous or unnecessary, for it is the mighty lever that is raising humanity, but education leads the mind and induces men to improve themselves, while rules or agreements to regulate or govern apprentices forces them into set channels, the very thing that should be avoided. Every boy or man has his own individuality, and when you hedge about it conditions, you are destroying his originality, and teaching him to depend on other people's brains, when you specify what length of time he shall serve in one branch or the other of the business. Every boy is placed on a level, the bright, active mind, the one with dulled, blunt perceptions, when it is stated the apprentice shall receive a certain amount each year, all served alike, it is cold blanketing the aspirations of the rising and energetic mechanic, and when such measures are adopted to improve the quality of our mechanics, it appears absurd. You cannot make good mechanics of all, or of one-half the apprentices we teach, yet the proposition is to treat all alike, our most promising and our most hopeless. This is not a question of making better molders, it is a question of procuring better men in the foundry, better boys, and that done, the molders make themselves.

The ordinary boy that finds his way to our establishments is simply looking for employment, the same as a section hand, he very seldom has high or lofty aspirations for the future, he wants work to provide for his present welfare, and possesses plenty of muscle; he understands the molder receives better wages than the laborer, and decides to adopt that business so he will be placed in better circumstances; occasionally there is one, it is true, who develops or uses an in-

herent quality he possesses and surpasses the rest, and these become our best workmen, but the apprentice who goes in a foundry, without the ambition to rise above his fellows, will remain where they naturally and mentally belong, simply machines, who acquire the education necessary to hold a position, and devote their efforts to copying how "Old Jack," or some other relic does his work, and come as near the mark as possible for a copyist. We don't want boys to follow the example of some other mechanic, or even the foreman; we don't want boys hemmed in with rules and regulations, but we want them to learn to think, to use their own brains, and when they do not possess that capacity, you might just as well give them a job in the corner making brake shoes, and make room for the brighter minds you meet.

If better men are wanted in the foundry than what we now possess, there is only one way to acquire them—make the foundry a place for better men. To-day the cultured, intellectual minds of our nation are not going to seek employment, seek to adopt as a profession for life, a trade that is one of the most laborious and ordinarily paid in the land, a trade, regarded in some cities as a synonym for ignorance and vice. They will not pass the opportunities that offer possibly smaller wages, but cleanliness of person and apparel, lighter work, muscles, not strained and weary with hard labor, mental capacities depressed by physical fatigue, as they will be after a day's hard work in the foundry, and for this reason many of our brightest intellects turn to occupations that neither pay as well, or require the brain power a good mechanic would. Dirt or excessive labor is no disgrace, but it carries its weight with the young man who chooses a business he intends to follow for life, and if better men are introduced in our business, some changes must be made.

First, make the foundry a cleaner place, this is done in some places, but not many, make every man a closet to hang his coat or dinner-basket in, don't force him to leave his coat lying on old flasks, his dinner bucket in the core room; furnish him ample opportunity to wash and cleanse himself thoroughly. How many machine shops you can visit that will have large sinks arranged, hot water, soap, and other necessities, and witness the men upon the hour for quitting wash themselves and start for their homes, looking clean and possibly happy, while a few steps to the foundry will disclose a different state of affairs, the men hot and dirty, sweaty and tired, have either to console themselves with an old bucket they used for a swab pot, or wash in the barrel they get water from to wet their sand. A few will do this, but the majority will go home dirty, where they can find a decent place to wash and it hurts the pride of a man, and others' estimation of his business, to see him issue from his shop, dirty and grimy with sand and sweat. Make the business as cleanly as possible, and you will attract better people to it.

Pay an apprentice what he is worth, if it is one dollar per day or two, make him feel that merit is ever recognized, and always hold before him the possibility of advancement. Never permit him to feel he has reached the highest point he can hope to attain, or restrict him to a certain number of years upon this or that kind of work. Many a good apprentice has acquired "don't care" habits simply by the environments placed around him. It is far easier to destroy ambition in the young than to inspire it into those who possess none. If you go into the market to purchase an article you expect to pay for it according to quality, why should you not pay for service in the same manner? You place a boy of inferior, and one of superior, talents side by side in the shop; you expect to pay both the same and have both serve the same length of time, and at the end of their apprenticeship pay the better one possibly twenty-five cents a day more. How little encouragement there is in that for the ambitious, the aspiring mind. The truth is we do not pay good molders enough, and often pay poor ones too much, in comparison, and who desires to put superior ability, when they possess it, on the level with the most inferior in their life's business?

Take from the molder the most laborious part of his toil if you desire better men. Place the labor of cutting sand, pouring off, shaking out, and similar work where it belongs—with the laborer. Make his work the scientific part of the business. If there are any brains to be used put him in shape to do it, not expect him to solve some troublesome question while digging in the sand pile in

the morning. Elevate his position and better men will occupy it. Place before him not only the possibility that he may do the best work in the shop, but make it probable he will, and expect him to do it. Many a foreman keeps two or three men doing the best work and never permit it to be done by anyone else, for the reason that those men are better fitted for it, and they do not desire to undertake the responsibility or extra labor involved in teaching an apprentice. Again, it may be their employer is very careful of his bad casting report, and the foreman knows if he permits a boy to make an expensive casting, and it is lost, he will receive censure for permitting a "green hand" to work upon it. It is also true that regular men on regular work are the most economical and make the best work in the shortest time. This fact of itself is almost sufficient to destroy an apprentice's opportunities to rise, and it is the hardest question of all to consider when the problem of better, all-round mechanics arise, for we do not live in an all-round age. Our times are productive of specialties and special men for special places, and if the employers of the country desire better general workmen they must regulate their foundries, their wages, and demands, instead of drawing the line close around their employes.

We also hear the oft quoted assertion: "We have not as many good molders as we did some years ago;" that the good mechanic is more rare, and not often found in our foundries to-day; that the business from a scientific standpoint is deteriorating as regards quality, and other nonsense of the same import. But this is not true. There are just as many good workmen in our country to-day as there were thirty years ago, and more, because of the increased education of the people and the development of ability, for the American people are better able to take care of themselves or excel in any pursuit to-day than ever in the history of the past. But other reasons have brought up this strange, but not unfamiliar or unexpected, cry of depreciated ability.

The molder of to-day, as before stated, is more of a specialist, he is taught more nearly one branch of the business, and becomes an expert in that. Constant experience and practice make him an adept in his line, but when you remove him from it 'tis not to be expected he will equal an expert in some other line. In this capacity he is more valuable to his employer and more safe from competition among his fellows. Some shops carry this system so far that a man may work for years on one job. It has become by continued association easy and profitable labor to him and brings a good return to his employer, and when he drops out and the vacancy is filled by a new man foreign to the job, compared to his possibly departed predecessor, the firm finds he cannot perform as good or rapid work, they send up a howl of terror that molders have fallen from the pedestal of science and are rapidly descending to the level of a ditch digger. Too often they do not consider competition has driven mechanics to specialize their efforts, the same as manufacturers specialize their business, and foremen specialize their men, by reserving or changing work so that the best adapted man will procure the work he is suited for.

A few years ago a foundry located in any of our cities would compete in almost any contract. Now the engine shop bids on engine work, the architectural shop on building material, and so through the entire list. With this specializing has come increased and cheapened production, the molder does more work, special facilities are constructed for every class, and the difference in the output is amazing. Place one of our old-time "good molders" in a live, modern foundry and see where he would end. He could not make the day's work some of our inferior mechanics do on brake shoes and bumpers, under any circumstances, and he would fall just as short when it came to accomplishing that which our crane molders or good mechanics do to-day.

These changes are not considered, the molder of to-day is expected to accomplish as much as a specialist and possess as wide a range of ability as the man who formerly had all the time he wanted on a job. Glance in our foundries to-day and see what a molder accomplishes in ten hours, then cast your mind back and recall what a molder did thirty years ago, and at least one reason will appear for the change in our men. Furthermore it is true that the quality of work to-day is superior to any ever produced in this

lines has perfected our methods of work and drilled our men to keener perceptions of what each individual casting required. But there have also been systems adopted in the office that show in glaring figures every pound of bad work made and bring vividly before the proprietors leaks and possibilities in the business that were hitherto unobserved or regarded with little attention, but when under the manipulation of system it resolves itself into dollars and cents, the faults appear colossal, and gradually becoming greater, while the truth is the office is simply discovering that which has always existed in the foundry. To-day every bad casting receives the notice of the office, its maker, weight and time of molding, where formerly the foreman corrected the mistakes, melted up the bad work, and little was ever thought of it.

Competition in business has brought our founders to study and regard every possible waste or leak with apprehension and efforts to check them, and the monthly report, which often shows 2 to 5 per cent bad castings, probably as much as their profit, causes them to quickly decide the reason they cannot compete or make a fair profit is because their molders make more bad work than formerly, and these evils must be corrected by changing the methods used with the men, not by changing the methods the men use. Good flasks, sand and facilities will reduce the percentage of bad castings quicker and more effectually than all the text-books, formulas, and discipline in the world.

Machinery also has its effect upon our business, the largest portion of our plain work that was formerly made by second-grade mechanics is now put upon the molding machine, and a greater number of this class find employment upon the better grade of work, to its detriment.

The natural inclination among our founders is to use the best man in the best place. This rule is based on common sense and economy in business, and also to use an apprentice where he would return the greatest profit. This may not be altogether the intention of the employers, but in nineteen foundries out of twenty it is actual practice. No one can dictate or say it is wrong, for it is often necessary in business. But better general mechanics will not be made by confining them to specialties, or better molders produced until better men are induced to enter the business.

Sand Sifting Machinery.

By G. D. RICE.

I suppose that every foundryman has some way of his own for sifting sand, and like myself, experiments more or less in hopes that he may improve upon present methods. That there is ample opportunity to improve upon sand sifters, none will doubt, and as the writer has tried some new ways of sifting sand, perhaps the accompanying diagrams of the mechanisms employed will be interesting. The first one illustrates a side elevation of a sand sifting machine which differs from some ordinary kinds in that the driving mechanism is below and the adjustment of the shute is odd. I built one of these to sift core sand and have received good results from it. The sifter A is provided with lips C, and these rest upon the swing frame B, as shown. The swing frame hangs upon the link rods D, there being one at each corner. A bracket E is bolted to the lower part of the swing frame, and connected with the crank F by means of the rod I. The belt revolves the gearing G as usual, thus giving power to the crank and setting the swing frame in motion. The sifted sand falls to the shute, from thence to the ground. The sifter A may be lifted at will and the coarse sand dumped.

Ball bearings being applicable to most every machine in which metal surfaces contact, your correspondent thought to apply the same to sand sifting machines, with the result that the device in Fig. 2 was brought out. The sifter A is set upon a wrought iron ring and this ring is grooved and is shown in section by B, B. The ring is set upon balls C, and the latter travel on the flat iron surface D. A toothed piece is secured to the bottom of the sifter at K and the gear E meshed into it, and this gear is given the necessary half forward and return motion by means of a crank I, which is keyed to its shaft, and which crank is worked by the wheel F. The peculiar roller motion developed by operating the round sifter on balls seems to me to be beneficial. At least, the process of sifting the sand appeared to be done effectively and quicker. No patent on

this or the next device, both of which are home made, and any foundryman may build and use the same if he chooses.

The next sifter, Fig. 3, also involves the use of ball bearings, and in this the bearings are arranged to be at the outer circle of the cylinder A, which cylinder is covered with the necessary wire and made to revolve. The ends of the cylinder are fitted with grooved flanges B, B, in which the balls C run, and the latter turn upon the similarly grooved cones or ball retainers C'. The ball retainers are adjusted to a frame, and the cylinder revolved by the pulleys at F. A plan view of the end of the cylinder and connections is shown in Fig. 4. The advantage of an arrangement like this, I found to be, consisted of less power to sift a given quantity of sand. Besides, the smooth revolving motion of the cylinder upon the balls is quite neat.

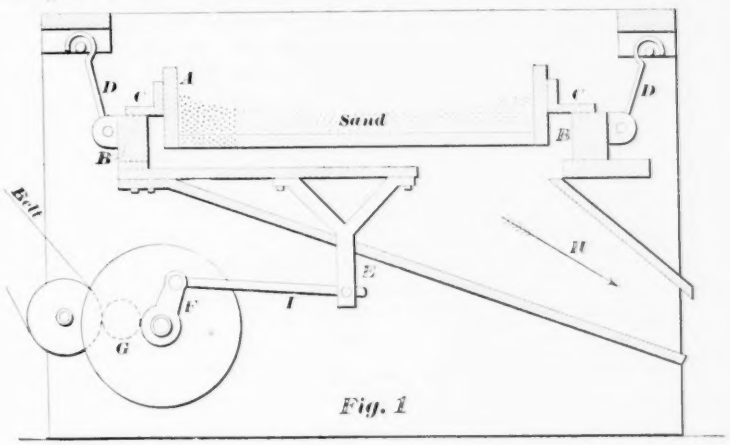


Fig. 1

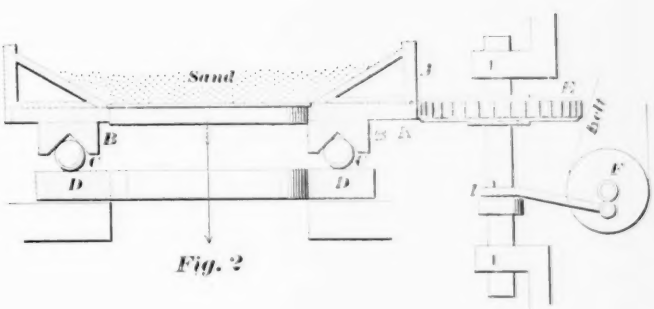


Fig. 2

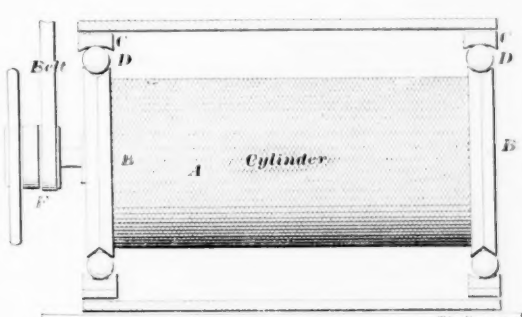


Fig. 3

Fig. 4

NOVEL TYPES OF SAND SIFTERS.

Controlling Iron Mixtures.

By V. L. WOLFE.

Among the many good articles that have recently appeared in THE FOUNDRY, none are deserving of more careful perusal than the one written by Mr. Beckett for the December issue. When we remember that the majority of the readers of your journal are practical foundrymen, men who have at one time in their lives handled a trowel, daubed a cupola, or weighed scrap, the value of ideas that pertain to the daily life of every intelligent molder cannot be overestimated. I agree with Mr. Beckett that enough attention is not paid, in what are called well regulated shops, to the importance of testing the iron used at regular and frequent intervals. A chemical analysis of iron is a good thing, but a testing machine is better—and cheaper. Every shop, large or small, ought to have one. If the proprietor cannot afford the luxury of a special machine, he might rig up one on a pair of common platform scales. If this is too expensive, he can fall back on the little twist bar, four inches long, operated by the aid of a four-foot lever and a pair of 25-cent spring scales. Any old thing is better than nothing. If you were to drop in on a foundry where test bars are not cast, but where the proprietor goes on the principle that as long as the iron runs and the castings look clean the quality of the iron is certainly all right, and have three one-inch square bars cast, one at the beginning of the heat, the second one near the middle of the cast, and a third just before the bottom dropped, it is safe to say that when subjected to a transverse test the result would be as 2,500 and 2,100 is to 3,000. Bring a testing machine into the shop and in a week's time—if the foreman was an intelligent man and the melter did not know it all—you could cast bars every day for another week none of which would break under 2,500 pounds pressure and none stand a strain of over 2,800 pounds.

Of course the bars must be molded by a careful man and be of exact size. Only no "doctoring" should be allowed. If the iron is not good enough to pour the test bar it is not good enough for the castings.

Agricultural shops, above all others, should have a system of determining the quality of the iron used in the construction of their machines. If the farmer who buys the machine knew as much about iron as the manufacturer thinks he knows about wheat, the gentleman from the rural districts would hesitate a long while before he bought a machine from a maker who could not furnish a guarantee as to the quality of the stock used in its construction.

In addition to being a sure medium by which the strength of iron may be determined, the testing machine acts as an educator to the foundry foreman and his melter. No one knows until he has tried the experiment of how much importance the sprues and overplus of one day's cast is in equalizing the heat of a succeeding day. The shot riddled up from the gangway, especially if an iron floor is used, and the small particles of iron milled from the cinders of the bottom can be used as a sort of sliding element, first put on one charge and then on another, as the case may require. None should be put in the furnace, however, after the middle of the heat is reached. The contents of the pig bed should invariably be put on the first and second charges.

As an illustration of the value of having a good testing machine around, I will conclude this article with a truthful tale. Recently a well known firm had three car loads of pig iron shipped to them. The quality of the iron was a matter of dispute. The foreman of the foundry was instructed to use only 1,000 pounds in a total of fifteen tons. The result was disastrous. Three hundred pounds was knocked off the strength of every bar cast. Succeeding tests showed no improvement. Then two car loads were sent back and what was claimed to be a better grade was returned in its stead. Same old story. Then the old mixture was resumed and the condemned iron was allowed to lay.

The foreman was a believer in the idea of patronizing home industries. Most of the iron being used by his employers came from the greatest country on earth, the despised brand didn't. One day after the matter had quieted down and the powers that be had turned their attention to more important subjects than looking over test reports, by arrangement with the superintendent 1,000 pounds of the condemned iron was put in

with an increased amount of another brand as a conqueror. The other brand was also a home product. Inside of a week there was being used over 6,000 pounds of each of the home articles, with the satisfaction of seeing each bar stand a test of over 2,500 pounds, which is the standard.

Molding and Gating Steel Castings.

By GEO. O. VAIR.

For some reason but a small amount of literature has appeared from the steel foundries. With the increasing use of cast steel a greater interest is taken in this material and the processes by which it obtains its superiority over other metals. By the courtesy of the American Machinist we reproduce this article for the benefit of those of our readers who are interested in casting steel.

Until comparatively recent times the manufacture of steel castings was confined to special jobs, such as required greater strength or durability than could be obtained from cast iron. However, within the last fifteen years great strides have been taken, and steel castings are now applied to a multitude of purposes, the castings ranging in weight from a few ounces to tons; therefore, it might be well for some of us iron molders to study up on steel foundry practice. Comparatively few iron molders have a clear

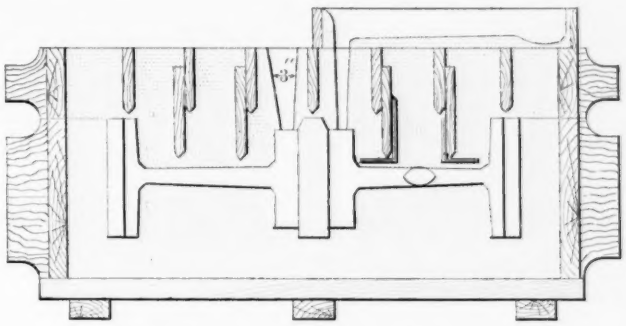


Fig. 1.—Green Sand Mold for Iron.

Fig. 3

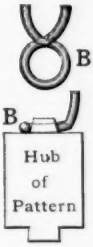


Fig. 4

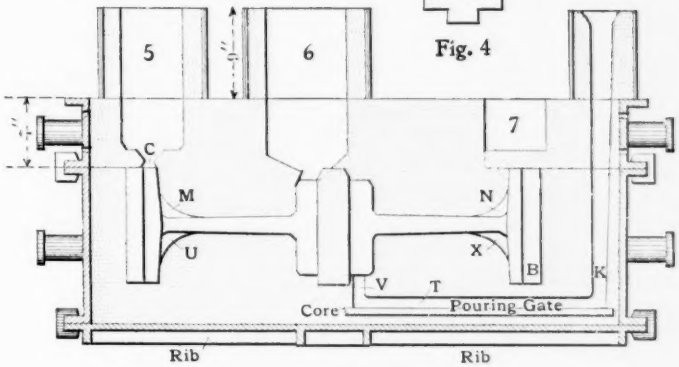


Fig. 2.—Dry Sand Mold for Steel.

American Machinist

conception of the difference between iron and steel molding, and the writer herewith presents sketches which may help anyone interested in forming an idea as to the dissimilarity.

Fig. 1 shows a sectional view of a spur-gear mold, as it is generally made in green sand, for cast iron.

At Fig. 2 is shown the same size of spur gear, molded in dry sand, and to be cast with steel.

As the green-sand mold represented in Fig. 1 is simply intended for comparison, it will be unnecessary to enter into the details of the molding.

It must not be understood that any ordinary dry-sand mixture that is suitable for iron castings will answer the purpose for steel molds, as it will not. The material used is known as silica sand, which is found in stone form, the same being ground finely.

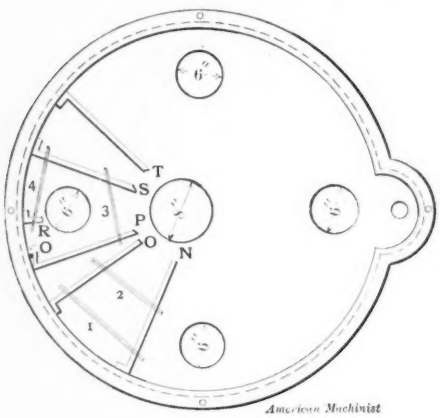


Fig. 5

When mixing the sand for use, flour and molasses water are added to give cohesiveness. One of the chief requirements of sand suitable for steel castings is that it will stand a high degree of heat before fusing. Of course, the above is in reference to the facing, or sand that is exposed to the flow of the metal. For backing sand, any grade will do which will bake hard. I might add that for gear teeth, or delicate projections, special sand mixtures are used.

All steel molds are also coated with a silica wash, which is applied as blackwash is on molds for iron castings. The washes for steel molds have been greatly improved in recent years. The result is that castings which formerly required days to clean now peel with the rap of a hammer.

In explanation of Fig. 2, I may say that the molding procedure is the same, or nearly so, as in green sand, with the exception that it is necessary to ram the steel mold much harder; in fact, the harder the better, for the reason that the molten steel is very penetrating, and if there should be any soft spots in the mold the metal would seam into them.

At T, Fig. 2, is shown the pouring gate, which enters at the hub. This gate, from the upright gate K to the short gate V, is cut while the mold is being made, and is covered with a core. The nature of the sand used for steel molding is to bake, or dry extremely hard, which allows the style of gate here shown to be cut quite close to the rim of the gear at B. There is no danger of the gate breaking into the mold if there are two inches of sand at the point mentioned.

The object in making the gate as shown is to avoid the splash and current of metal as it rushes from the ladle. The outlet in all steel ladles is at the bottom; consequently, when they are full of metal there is a great pressure on the pouring gate. Even with all precautions in gating, it is deemed necessary to surface-nail all molds, more or less.

The shrinkage heads, 5, 6 and 7, Fig. 2, will look extremely large to the iron molder; but they are absolutely necessary to the production of sound steel castings. The manner in which the above heads are cut to the shape shown, where they connect with the casting at c, will be readily understood by referring to head 7. After taking out the shrink-head pattern, the head is rammed up to the depth of 2½ inches; and when the cope has been lifted off and turned over, the head is then cut to the desired shape with a molder's tool. The object in making the heads the shape here shown, is to have them as small as practicable where they join the casting, and yet such shape as to retain the metal in the shrink-head fluid for the longest possible period, thereby giving pressure and obviating shrinkage.

Fig. 4 shows a device used in steel foundries to center the core by, which is necessary, owing to the shrink-head on the hub being cut into the core print, thus destroying

the guide to hold the core central. To provide a guide, a piece of wire the required length is simply pulled around the core print, and the ends turned up so that they will protrude a short distance into the cope sand. I do not think that the wrinkle just explained would answer the purpose intended if used in any other grade of sand, but in silica sand, dried, it is perfectly secure.

Fig. 3 is a side and end view of the cast-iron flask bars used in the cope. A plan of cope and shrink heads is shown at Fig. 5. On account of the large heads used on steel castings, there is no attempt made to have regular barred flasks, especially on jobbing work; and for jobs such as we have in hand, the bars shown are generally used, broken off to the length wanted. At N, O, P, R, S and T, Fig. 5, there are shown six bars in the cope, and at 1, 2, 3 and 4 are seen wrought-iron rods, which are run through the holes in the cast-iron bars, to help to support the sand and to hang gaggers on. All gaggers used in steel foundries should be made of wrought iron, with a short bend on one end to admit of hooking them over the flask bars. To fasten the bars in the cope, there are bolts; but instead of screwing them up, the usual practice is to drop the bar into place, and then drive an iron wedge or piece of scrap in between the bar and flask, as shown at O on bar P.

To secure the copes from damage while "green," most of them being widely barred, there are plates, similar to the ones used on the drag, clamped on top of the cope. These plates are removed after the mold has been dried.

There are more steel castings lost through contraction than from all other causes combined. This can be accounted for largely by the extreme hardness to which the sand used will bake, thereby resisting the free contraction of the casting.

At x u, z and m, Fig. 2, are brackets cut on the arms of the gear, the same being necessary to keep the arms from breaking at that point. Usually, a steel foundry foreman will give more study to properly bracketing a casting than to any other one subject.

I have heard iron molders remark that the only requisite to being a good steel molder was a stiff back and a weak mind. Although a steel molder would be a failure on green-sand work, his mental abilities would be of as much use to him in the steel foundry as in an iron shop.

Phenomena of Cast Iron Investigated.

By S. S. KNIGHT.

Every one familiar with foundry practices, especially those pertaining to iron metallurgy, if possessed with a thoughtful disposition, must have, when experiencing phenomena connected with this metal, tried to find some explanation of these satisfactory to himself.

It is the purpose of the author to show in this article how some of these may be explained, and in doing this to avoid as far as possible the use of technicalities employed only by those whose work is connected with the natural sciences.

In the first place, it should be known, that in order to investigate any of the phenomena of nature, it is necessary to adopt some statement founded upon observed facts, which the investigator may use as a basis for his further operation. This statement need not be necessarily true, but should be in accord with all the knowledge which the operator possesses at the time it is formulated; that is, it should be as near the truth as it is possible for the investigator to make it, and yet be general in its application. Such a statement should be reasonable, and above all, should have no prejudice in its favor with the investigator, except its appeal to his integrity and the evidences of its truth. Such a statement is called an hypothesis.

It will be readily appreciated by those who have ever thought upon physical subjects, that an hypothesis, even though incorrect, is better than none at all. From this it should not be inferred that a theory should be created in order to explain any individual phenomenon. An hypothesis should be made only upon due consideration of a collection of facts, and then only in accordance with all previous observations.

A theory that has been proved true by the most crucial tests and all the facts that could possibly be brought to bear upon it and that satisfactorily explained all phenomena, that subsequently had been inexplicable and unrelated, may be, although purely inferential

assumed as approximate truth, if it can be utilized in further investigation. Such a theory is that which all scientists hold concerning the space which everywhere exists about us, namely, that this space is not empty, but is filled with a substance unaffected and frictionless to translational motion, although stressed by molecular vibratroy and rotary motions. This substance is called the ether, and is not identical or similar to matter, being homogeneous, nonporous and perfectly elastic. It is through this ether that light is transmitted at the rate of 186,000 miles per second, transmitted as transverse vibrations, sensitive to the optic nerve, and capable of producing vibratory motion among the molecules of the substance upon which it falls; in other words, capable of producing a condition in the matter that arrests it similar to that from which its origin was due.

This same ether is also the medium through which attractive and repellant stresses are transmitted, when the attracting and repelling bodies are not contiguous. Thus magnetic and electrical attractions and repulsions and the attraction of gravitation are transmitted.

It is generally known that all matter is made up of some seventy-two elementary kinds—elementary because as yet scientists have not been able to transform one into the other, and because each individual kind possesses properties solely its own and inseparable from it regardless where such form of matter be found. It has also been universally conceded that each individual kind of matter is composed of an infinite number of indivisible particles called atoms, and that such atoms have the power to combine with each other, and the particle so formed is called a molecule.

As to how matter became to exist and from what it was made, and even as to the very existence of atoms and molecules, human beings conditioned as at present will never be able to certainly know. But from the teachings of modern physics and chemistry and the progress directly due to them, we are able to say with almost as much certainty as if they were discernible to the human eye, that atoms and molecules do exist, and to speculate with some possibility of finding the truth as to from what they were made and the condition which brought about their existence.

Every one has probably noticed the rapidly revolving rings of smoke which, in a still atmosphere, rise from the stack of a locomotive, when the exhaust steam is suddenly admitted therein. Looking at such rings from the bottom, they are seen to revolve rapidly from the outside towards the center, and when uninfluenced by currents of air, to move in a direction constantly perpendicular to the plane of the ring at the moment of its appearance. Such rings may also be produced by cutting a small circular aperture in the front of a box and stretching tightly across the open back a sheet of thin India rubber. Burning rags or chemicals may be used to produce the smoke. In the latter case strong hydrochloric acid and ammonia are used, being placed in open dishes in the box. A sudden tap on the stretched rubber will produce a vortex ring, whose properties may be now experimentally studied.

The investigation by Helmholtz shows that two factors are necessary in order to produce such rings; first, gaseous substance of some kind; and second, motion. If such substance be frictionless to translatory motion, a ring once produced would continue to vibrate for ever in accordance with Newton's first law. The vibration of such a ring if, after being produced, impact with other rings or bodies occurred at the circumference, would cause it to assume no longer a circular outline, but to vibrate as an ellipse; the elongation of the major axis being the maximum when equal to four-fifths of the diameter. Observations made upon rings produced by smoke have determined five important things: First, that the amount of gaseous material in the ring is constant; second, since it possesses motion, it also possesses momentum; third, that it is attracted by adjacent objects, especially if the axis of propagation be parallel to their surface; fourth, that it will push bodies free to move out of its path in front of it, and will draw those behind after it; and fifth, if impact takes place between two rings, the periods of their vibrations are proportional to their rates of rotation. It will also be noticed that if two rings be formed adjacent to each other, their attraction will be mutual, and also that each may break at the point

of intact, and the ends may be welded together, forming a single ring, which will continue to move on as an individual in the original plane. The observation here noted of two rings is likewise applicable to three. It also may be noted that a ring if once broken when not contiguous to other rings, is destroyed and no longer exists as such.

If it be granted that rings of ether could be produced, then the analogy between the properties of these rings and the properties of matter itself will at once be comprehended. It will also be understood how there can be such indivisible particles of matter as atoms are conceded to be, and how indivisibility would become a definite property, since if a ring be once broken, its properties are destroyed. The power of two or more such rings to combine will show at once the possibility of molecular formation. So in the subsequent explanation it will be taken as granted that atoms are vortex rings of the ether in the ether.

Now, as to the phenomena of cast iron. The effect of silicon in the presence of carbon in cast iron has been long known. The action of silicon is catalytic, or in other words, the field produced by the vibration of an atom of silicon so overlaps or neutralizes the field resulting from the union of carbon and iron that the mutual attraction of the iron atom and the carbon atom is so diminished that the carbon atom is set free. Since cohesion is due to gravitative attraction of a molecular rather than a molar kind, and chemism is also due to the same source, it is easy to see how this action of silicon is accounted for. It is to be remembered that the attraction of gravitation varies not only directly with the masses involved, but also inversely as the square of the distance between the centers of the attractive masses. Although the distance seems so very small between the molecules of the elements in question, let us see how this action is produced. Consider two adjacent molecules of iron and iron carbide. Suppose the molecules to be separated the one-fifty-millionth of a millimeter, which we will take as the diameter of the iron atom. Let the mutual attraction be represented by the one-millionth of a millidyne. Now, suppose this molecule of iron carbide to be broken up, and consider again the attraction of the two iron atoms with the carbon molecule between them. Neglecting the shape of the molecules or supposing them similar in both cases to the respective atoms, we have the distance doubled and the mass but three-quarters of what it was. This, of course, presumes the atoms of all the elements involved to be the same size at constant temperatures, which in this case is approximately true. Hence the attraction is $\frac{3}{4}/\frac{1}{1}$ of what it was, or three-sixteenths of one-millionth of a millidyne. It will thus be seen that the attraction where the carbon is in the free or graphite state tends to decrease the density, and consequently the shrinkage is but three-sixteenths of what it was when chemically combined with the iron. This computation, of course, presumes that the metal contains 30 per cent carbon, which is about twelve times the amount of carbon which an ordinary iron carries. It will easily be seen from the foregoing computation at least one of the ways by which silicon may decrease the shrinkage, and also the density of iron.

Let us next consider the action of sulphur on iron. What influence this element has, has already been shown in a previous number, so space will not be consumed in reviewing the physical characteristics of iron that are superinduced by sulphur. It exists in iron in two chemical combinations; first, as a metallic sulphide; and second, as alkaline or quasi-alkaline sulphates. By far the larger amount exists in the first form, and since the amount of sulphate sulphur usually in good iron—metal clean and free from slag—does not exceed the one-eightieth part of the total sulphur, it may be considered as non-potent in producing the phenomena due to the presence of this metalloid, and hence wholly ignored. Suppose the metal to contain .1 per cent of sulphide sulphur or 0.001 part, this when combined with iron would give over .0027 part of iron sulphide, which, as is well known, is brittle, weak, non-magnetic, and in general possesses those properties which iron does, only in a less degree, when it carries a large percentage of sulphur. So it is no more wonderful that iron high in this element should possess the properties of the sulphur compound mixed with it than that in an alloy of a hard and a soft metal the hardness of the alloy would be proportional to the amount of the harder metal which the alloy contained. The reason that this com-

bination of iron and sulphur exists so greatly to the exclusion of other compounds is because under the conditions the iron and sulphur possess the greater chemism or attraction, and hence the stronger power of combination.

What compound or compounds any number of elements will form is purely due to the conditions which they are subjected to. Thus, as previously shown, at a low temperature iron and phosphorus form the protophosphide of iron, and at a high heat the atoms vibrate not only more rapidly, but the amplitude of their vibration is increased and hence their attraction for each other also, and the compound assumes the most stable form. This action is somewhat analogous to that of hydrochloric acid upon manganese dioxide. In this case manganic chloride is first formed together with water, but when heated two atoms of chlorine are freed and manganous chloride is found, which is the more stable compound. MnO_2+4HCl $MnCl_4+2H_2O$ and $MnCl_4$ $MnCl_2+2Cl$.

In reviewing the action of phosphorus upon iron, the fact that segregations of phosphorus are always existent, regardless whether the metal be soft or hard, should not escape notice. In fact, this is by far the most important observation on the properties of this element when combined with iron. The weakness of metal so often attributed to phosphorus, and indeed most truly so, is purely due to collocations of particles of phosphorus united with iron, and it is most noticeable that if the castings be small, solid and cast horizontally, such as tensile and transverse bars, the so-called weakness is almost entirely non-present. This, of course, is due to the diminution of those factors, such as pressure, etc., which have been shown in a previous article to be so potent in unfitting large iron castings for opposing heavy strains. As to what quantity of phosphorus is harmful to the metal must be determined entirely by the size and shape of the casting and the method of molding it. In flange cylinders the relative time at which the breaking strain took place may be determined by the appearance of the fracture. If, for instance, the metal shows a bright metallic fracture, it may at once be concluded that the shrinkage or contraction which produced the breaking strain took place after the metal had set throughout, or at least after both surfaces had become plastic. If, on the other hand, the fracture does not present a bright appearance, but appears more or less dark and non-crystalline, it is equally certain that the breaking strain was produced before the metal had set. Hence it may be seen that while in many cases the so-called "sinking heads" usually cast on the upper end of such cylinders may be not only non-advantageous, but decidedly harmful, since the excess of metal will retain the heat and consequently will render fluid that part of the cylinder directly below them until after their lower surface has solidified together with the greater portion of the lower part of such castings, thus leaving fluid metal to withstand the strain produced by the contraction or shrinkage.

Concerning manganese, little need be said, since whatever phenomena are due to it are directly traceable to the effects of combined carbon, as in all foundry irons, the greater percentage of this element exists as carbide. Usually, however, no certainty can be placed upon its action in any given case, since even the carbide does not materially affect the strength of the metal; its only effect being to increase very slightly the density of the iron.

Its action is strongly in contrast to that produced by even minute traces of titanium, which not only renders the metal close, but very strong. The reason for this seems to be that the iron in becoming much more dense has the distances between its particles diminished, and hence their mutual attraction is increased in the ratio of the universe square.

Iron that contains over one-tenth per cent. however, is likely to have faults that affect its advantages, such, for instance, as high shrinkage. This is due to the stability of its carbon compound, and the resulting high carbon or lack of graphite in the metal.

It has been a question often asked the author as to the cause of the chill which is so often to be seen in irons which are technically called hard or steel irons. A number of furnace men were asked to give their opinion as to what seemed to them to be the most operative causes in producing this phenomenon.

The majority concurred in the belief that the so-called "chill" was due to a segregation of manganese. To ascertain if this were the fact a number of pigs were taken of different brands and drillings made both in the chill and in the unchilled exterior.

Subsequently analysis of each pig was made from both samples of borings taken, but completely failed to establish the truth of the supposition, inasmuch as no excess of manganese was noted.

The two analyses made on each pig practically checked, and hence this theory was dropped. Investigation was continued and all results noted that had any possible bearing on the question. In the first place, it should be noted that the phenomenon considered occurs in only "hard" or high shrinkage irons, and second, that the chill is greatest in the center or the last place of cooling, and radiates from this in the directions of the larger quantities of metal.

The explanation of this phenomenon can now be intelligently considered. The shape of the mold for the pig is such that the metal, when admitted, first sets around the outside or adjacent or contiguous with the sand, and then the upper part or surface of the pig. Since the pig is stopped off as soon as full, the end near or part adjacent to the sow then solidifies. The pig now resembles a tube closed at both ends and whose diameter as well as the length is constantly diminishing with the force of a miniature glacier.

The process of solidification continues until the last iron that sets congeals under a pressure of several tons, and hence is necessarily dense or chilled.

The radii simply show how the greatest amount of metal was more difficult to cool or took longer to conduct and radiate its heat away and hence remained fluid the longest, and so was subjected to the greatest pressure. This explanation also throws light upon a somewhat analogous phenomenon which is observable in "soft" or non-shrinking irons, namely, the formation of a hole which is often filled with graphite.

The explanation of this phenomenon is similar to the other, in that the pig cools in the same manner, forming a tube. Since this phenomenon occurs only in soft irons, or that metal which expands upon cooling, it is easily seen that metal setting subsequent to the cooling of the shell must be drawn toward the cooled exterior, both because of its greater density, and because of its crystalline formation, while at the same time its graphite is thrown out and inward into the liquid metal by the process of crystallization. A pocket of free carbon must therefore be formed at the center of last place of solidification in the pig.

All intermediate grades of these phenomena may be seen, but the causes given in the two extreme cases hold good and effective in all.

Before concluding this article the author wishes to make a few statements which may, in part, be considered as an apology for making such positive assertions, and also to correct any wrong impressions which may have been formed by those who have had the patience to read them.

The statements made are to be considered as applicable *only* to that part of iron metallurgy and foundry practice which is to be met with in the requirements of the ordinary iron foundry. Thus, when it was stated that certain elements could in all probability not be eliminated from iron by any practical method or procedure, the cupola only was considered, since the open hearth furnace and converter are not included in the equipment of the average foundry. But the statement made with reference solely to the cupola is also equally valid when applied to the other apparatus mentioned. It is not here wished to assume the prerogative of speaking for metallurgists with reference to other preferential combinations of iron with the various metalloids which almost invariably in some form or other are found mixed with it, but it is nevertheless true that even at such high temperatures as are possible to be obtained in the open hearth furnaces that the last traces of sulphur and phosphorus, although somewhat volitized, are not completely expelled. At 3,000 degrees Centigrade, if it were possible by artificial means to eliminate these elements either in the presence of acid or basic slags, it certainly would have been demonstrated previous to this time. But what seems the most remarkable is that the smaller quantities of these two elements that exist in any given metal are difficult to eliminate exactly in the inverse ratio to the amount existent. Two quotations here given are from a paper read by Mr. H. H. Campbell before the Chicago meeting of the International Engineering Congress which convened in August, 1893.

In part he says: "It is probable that the affinity of phosphorus for iron decreases as

the phosphorus-content increases, so that when this element is present in large proportions, it may be oxidized even in the presence of a strong carbon-reaction. With a combination of high carbon and low phosphorus, the percentage of elimination is very uncertain. Silicon drops with comparative readiness to .02 or .01 per cent; manganese to about the same point; carbon to .05 per cent or thereabout; but the remnants then hold on with the vigor of despair. This strong persistence of traces, which holds good not only in iron metallurgy, but throughout the domain of chemistry, is merely the last member in the series of preferential relations."

This may be easily explained by considering the action which the different substances present have upon the fluid metal. In the acid furnace no elimination of phosphorus or sulphur have ever been known to take place, and only in the basic furnaces when all conditions which could be controlled were most favorable. By the addition of a recarbonizer, or rather a resiliconizer, which is usually an ore, ferromanganese, ferrosilicon or spiegel, the carbon is increased, but not intentionally so, while whatever manganese the addition may contain is almost at once oxidized either by the flame or by the slag. Thus the desulphurization of those particles of iron which are in contact with the addition or the basic slag may either take place in accordance with the equation. $Fe\ S + Ca\ O + C = Ca\ S + CO + Fe$ or indirectly through the mediation of the manganese. $Mn + Fe\ S = Fe + Mn\ S$. $Mn\ S + Ca\ O = Mn\ O + Ca\ S$. But it is to be remembered that these reactions can only take place when the particles of iron are in actual contact either with the manganiferous addition or the slag itself, and since the velocity of the translational motion of the particles in the bath must necessarily be quite low, it is easily seen how it would be impossible to eliminate the last traces of these metalloids by this process before the carbon would be in too great part burned out. Thus what was observed in practice with the cupola holds equally good when generalized and considered with reference to either the open hearth furnace or the converter.

Great Melting.

"Once upon a time," in a village in northeastern Iowa, I was, with two other men, conducting a small manufacturing plant. One day we were startled by receiving a genuine order for a 500-pound pile driving hammer.

Our cupola was very small and none of us knew any too well how to manage it. But we accepted the order and determined by hook or crook to fill it or bust! I was foreman of the foundry, molder, melter, laborer, etc., etc. I knew nothing about cinder beds, or bedding work in the floor, but I dug a hole in the foundry floor and molded the hammer therein. After drawing the pattern I went to the scrap heap and picked out a lot of clean scrap sleigh shoes and other scrap, and packed into that mold just as much of it as I possibly could. My pouring gate led directly down through the cope onto the scrap. The cast was a perfect success, but in use the hammer proved to be too light, and we were soon after delighted at a visit from our customer, who ordered another hammer, to weigh 1,000 pounds. "And," said he, "gentlemen, I don't know anything about this casting business, but when you make this hammer I wish you would fix it up somehow so that the sleigh shoes won't show on the outside!"

"I hain't got no fault to find with the hammer you made—it works all right and is all right, but it don't look very nice to see them sleigh shoes standing up on end around the outside of the hammer!"

We did a better job on the 1,000-pound hammer than we had done on its predecessor, for, though it was crammed to its utmost capacity with old sleigh-shoes and other scrap, there was no visible sign thereof in the finished casting. This was a great many years ago—long before the melting of 10 of iron to 1 of coke had been claimed as possible—so I think I may justly claim the distinction of being a pioneer in advanced melting.—The Tradesman.

The Pittsburg Foundrymen's Association met at the Builders' Exchange February 22. Owing to the inclement weather and the consequently limited attendance, it was decided to postpone the regular order of the meeting one month, when efforts will be made to secure the attendance of all foundrymen in Pittsburg and contiguous territory.

A TECHNICAL JOURNAL DEVOTED TO FOUNDRY INTERESTS.

THE FOUNDRY

Published Monthly by

"The Foundry Publishing Co."

DETROIT, MICH.

JOHN A. PENTON,

EDITOR AND PROPRIETOR.

DETROIT, MAR., 1897.

Entered at the Post Office at Detroit, Mich., as second-class matter.

Subscription—One Dollar per year in advance in all parts of the United States and Canada; one dollar and seventy-five cents per year to all parts of the Universal Postal Union. May be sent by express, draft, money order, registered letter or U. S. postage stamps. Single copies, 15c.

Club Rates—Eight or more subscriptions sent at one time, 75 cents per year each. Cash to accompany order.

Advertising Rates Furnished Upon Application.

Subscribers can have address changed as often as desired.

If you fail to receive your paper promptly, please notify us.

THE FOUNDRY

Is issued promptly on the 20th of each month, and will spare no endeavor to furnish valuable news and information to those interested professionally or incidentally in molding, melting, mixing of metals, foundry management, etc. Persons connected with any of these lines of industry will confer a favor upon the Editor of this Journal by sending him news from their section of the country pertaining to the foundry interests, particularly individual theories and experiences of practical value.

THE DETROIT NEWS COMPANY,

Publishers' Agents, Detroit, Mich.

DEALERS SUPPLIED BY

The Albany News Company, Albany, N. Y.
The Baltimore News Company, Baltimore, Md.
The Brooklyn News Company, N. Y.
The Buffalo News Company, Buffalo, N. Y.
The Central News Company, Philadelphia, Pa.
The Cincinnati News Company, Cincinnati, Ohio.
The Cleveland News Company, Cleveland, Ohio.
The Colorado News Company, Denver, Colorado.
The Detroit News Company, Detroit, Mich.
The Minnesota News Company, St. Paul, Minn.
The Montreal News Company, Montreal, Canada.
The National News Company, New York, N. Y.
The Newark News Company, Newark, N. J.
The New Orleans News Company, New Orleans, La.
The New England News Company, Boston, Mass.
The New York News Company, New York, N. Y.
The Northern News Company, Troy, N. Y.
The Omaha News Company, Omaha, Neb.
The Pittsburg News Company, Pittsburg, Pa.
The Rhode Island News Company, Providence, R. I.
The San Francisco News Comp'y, San Francisco, Cal.
The South West News Company, Kansas City, Mo.
The St. Louis News Company, St. Louis, Mo.
The Toronto News Company, Toronto, Ontario, Can.
The Washington News Company, Washington, D. C.
The Western News Company, Chicago, Ill.
The Williamsburg News Co., Brooklyn, E. D., N. Y.
The Wisconsin News Company, Milwaukee, Wis.

Trade Outlook.

That combinations of manufacturers seeking to obtain more than a legitimate profit furnish the rope with which to hang themselves was shown in the collapse of the steel rail pool. It experienced little trouble in maintaining prices, but consumers held the winning hand by refusing to purchase materials at exorbitant figures.

The long life sometimes enjoyed by such concerns is either due to a tendency on their part to treat the consumers with just enough liberality to prevent competition or to the difficulty of securing a large enough capital to make competition effective. It would practically be an impossibility for foundry interests to amalgamate on such lines as have been followed in other industries. The relatively small cost of a foundry would cause these to spring up like mushrooms were an attempt to be made to secure a profit very much above the normal.

The extraordinary low price at which rails have been sold has resulted in heavy purchases by the railroads. As rails can not be laid or produced without the consumption of castings we may expect that a large business in this line will reflect itself in increased orders for castings. To the greatest extent lively business for one industry means an impetus to a number of others.

The tendency towards a large production of pig iron seems to have ended, the increase for the past month being scarcely noticeable. A very large share of the production is that of furnaces directly connected with steel works and rolling mills. Pig iron consumption is slightly greater though prices are weak on early deliveries because of the anxiety of furnace men to obtain cash.

Moderate sales of northern pig iron have lately been effected. Lake Superior charcoal is being sought after with more activity than has been the rule the past few months. There is but a perceptible advance in prices if any actually does exist. It is becoming plainer every day, as we have repeatedly pointed out in these columns, that any heavy advance in prices need not be looked for. What is needed, and we are slowly getting it, is an increased amount of work at prevailing prices. The progressive founder recognizes this changed aspect of affairs, and is adjusting himself to present prices by install-

PUBLIC LIBRARY
DETROIT MICH.

ing such improved appliances as will permit him of producing castings at a profit where formerly a loss was sustained.

Hunting for Mixtures.

To the average foundryman nothing appears simpler than to regulate his iron by his neighbor's judgment. He hears of a foundry that is making a reputation for excellent castings, and his first thought is to obtain by hook or crook the percentages of different brands employed. He succeeds, and what is the result? He does not know any more than he did before. He uses so much No. 3, No. 1 and scrap and wonders why the result is not identical with that obtained elsewhere.

Again he asks, what iron is suitable for gear-wheels; and, strange to say, a hundred voices are ready to furnish him with formulas, regardless of the fact that a satisfactory answer to such questions is only obtained by experience and cannot be transferred to another by simply mentioning the numbers of different brands of pig iron with a certain amount of scrap. We are in doubt as to which side should receive the greatest blame, for both are victims to a custom which teaches that iron can be mixed, by the aid of a recipe, like drugs.

No one can say off-hand what will constitute a satisfactory mixture for any class of work, as this can only be determined by subsequent use or tests. Hunting mixtures is a practice very much to be discouraged.

An Exception.

It is something out of the usual course for us to publish as reading matter parts of pamphlets issued in the interest of individual firms. To tell the truth this is probably because all catalogues are generally mere price sheets and offer nothing of interest to the average reader, nor do they divulge any of the methods by which the perfection of the finished product is reached. A notable exception to this practice is a pamphlet, recently issued by the Lewis Foundry and Machine Company, of Pittsburg, Pa., bearing the title "Something About Chilled Rolls," which we reproduce elsewhere. When the average foundryman succeeds in perfecting his methods his first thought is to keep the process locked up within himself as much as possible. Ever ready to absorb, he is slow in reciprocating.

Those of our readers interested in chilled castings will find much in this article that will prove useful on many other occasions. Uneven chilling causes several losses besides the inferiority of the casting itself. Irregular contraction and undue strains are produced by it. In THE FOUNDRY for June, 1894, Mr. Alex. Cairns called attention to some faults in car wheels that are caused by the defect of which this pamphlet treats. We commend the action of this firm in publishing the result of their investigations, which must have been preceded by a great amount of studious application. In reproducing it we are paying the highest compliment possible to the intrinsic value of their pamphlet, which contains something besides a neat cover.

Is it Useful.

The Industrial World says that Prof. W. C. Roberts-Austen has discovered a beautiful alloy, composed of 78 parts gold and 22 parts aluminum, which has a rich purple color. Will some one please tell us what he is going to do with it?

Kranks' Korner.

Do not be too sarcastic in your remarks when a new man enters the shop. The best mechanic never carries the air of one who knows it all.

* * *

The shop accepting work at the smallest price does not always pay the lowest wages.

* * *

A covering of powdered charcoal will largely prevent the oxidation of zinc and other metals from the brass furnace during melting.

* * *

Poor firebricks and long heats never keep company for any length of time.

* * *

We are all in the habit of making promises. When the chances are in our favor we demand all that we can possibly get, and when conditions are reversed we grant such concessions as we may be compelled to. One of the most frequent of promises made by employers is to give their men assurance of

steady work, when ordinary experience should convince them that such promises are at least uncertain of fulfillment. At the present time there are thousands of this kind of promises being ignored and causing a subdued dissatisfaction that will only react on the giver as soon as industrial conditions take an improved turn. Of course, no employer can retain his men unless he has work for them to perform and the man who accepts glib promises is almost as much of a knave as the one who dispenses such, for a knowledge of business affairs should teach both that such an arrangement is one-sided, and calls for conditions over which neither party exercises any control. Nevertheless, much of the friction between capital and labor comes from this source, and it would be well for all parties not to sanction agreements, grant concessions or make promises which from the natural order of things can never remain unbroken. Nothing is gained by the temporal supremacy accruing to either party from such transactions. No promises should be made that can not be kept.

* * *

Foundries as a rule are not the followers of fashion, though an occasional fad attracts them and becomes contagious. A recent article advocating an increased use of the snap flask recalls the epidemic that spread over the country a few years ago, when there scarcely seemed to be a limit to the field for the handy snap. When the laws of gravitation or inferior molding sand decided that the limit had been reached, alterations were made whereby bars could be inserted, and again the snap flask was proclaimed the medium by which foundries would be put on a dividend paying basis.

There is unquestionably many jobs that could with advantage be made in snap flasks, and it is also true that there are many castings made that way for which it would be a paying investment to make special flasks and hang the snap up as an example of how things can be overdone. When a snap mold becomes of such dimensions that it has to be barred, jacketed and clamped, it is a question whether a flask avoiding some of the labor that must be bestowed on these things would not be more economical. I used to be a krank on snap flasks once myself and never saw a casting but what I instantly was devising some scheme whereby it could be made in the "knock me down." I had helped to get up a rigging or attachment to a snap flask whereby a molder possessed of sufficient muscular energy could put up fifty molds a day, and felt somewhat jubilant when I went over to another shop where they had a similar job and were making it in special flasks. By the way of an introduction to the foreman I was about to slap him on the back and call attention to his inferior way of working, but then I reflected that such action might shock him too rudely, and concluded to administer my medicine to him slowly. In a sort of an indifferent manner I inquired as to how many castings he got a day of this job, and with an unconcerned smile he replied: "Sixty." Now it was my turn to feel shocked, but then he lied or else he was joking. It was an impossibility to get ahead of a snap flask, and I determined to keep track of the floor, and no doubt I would have the satisfaction of demonstrating to him his inability to compete with the all-conquering snap. But I never got the chance. While I had been spending a certain time putting in loose bars and a jacket or two to keep the mold from spreading out my man with his special flask had been molding right along, with the result that he showed a constant gain. He was "sawing wood" all the time, while I had to adjust each flask before I could proceed.

There is a legitimate field for the snap flask that nobody will dispute, but when we come to work where the volume of iron is large, or such castings as plates, where there is a great strain, then the snap flask ceases to be a virtue and more substantial appliances reduce the size of the scrap heap.

The new man in the shop is subjected to much criticism and scrutiny, but he very often has several handy kinks up his sleeve which raise him in the eyes of the older men. This makes it rather risky to indulge in any sarcasm as to his way of working till you know how much work he can do in a day; he may paralyze the old method when it comes to time.—Machinery.

I don't want to be without THE FOUNDRY. JOHN B. McLAREN.

Springfield, Mass.

Something About Chilled Rolls.*

Chilled rolls and sand rolls are both made of cast iron, and are cast on end. The interior of the molds for sand (or soft) rolls, is wholly of dried loam sand and the rolls are of one character throughout. Chilled or hard rolls are not of one character throughout, as the surface of the bodies is hardened by chilling while the interior is of different physical structure. This chilling of the surface is done by having the molds made in part, of dried loam sand and part cast iron. The necks or journals, and the wabblers, or coupling ends of the rolls, are made in the dried sand parts of the mold—that is, in the upper and lower ends of the molds—and the middle or bodies, are cast in very heavy cast iron cylinders or "chills," and which shall herein be referred to as "chill molds."

It is by these means that the ends are wholly of gray iron, while the surface of the bodies is hardened by chilling, as a result of the hot iron coming in contact with the cylindrical iron chill mold.

Through a vertical spout, the molten iron enters the mold at the lower end, but is not allowed to enter direct; instead, the stream is made to strike the circular chamber at a tangent, for the purpose of compelling a swirl of the whole body of the fluid iron within. By the centripetal force impelling the swirl, any dross that may be in the molten metal is gathered in the centre and rises to the "sink-head" on the upper end, which is afterward cut off; without the swirl, much of the dross would be found on the surface of the rolls. The means for swirling the molten metal within the mold was a great invention, and is still a valuable feature in the casting of chilled rolls. It was invented by James Harley, of Pittsburg, Pa., and to whom the government granted letters patent in 1835. It is the only originally patented feature in connection with chilled roll making which, up to this date, has met with wide recognition and permanent adoption. Later it was applied to sand roll making. It is still used wherever chilled or sand rolls are made either in America or abroad. Many attempts at improving the present method have been made since Harley's time, but none have been of real value. The chill molds which form the bodies in casting have been a favorite subject for would-be inventors to work upon, but until lately without success. "Water chills," "built up chills," "split chills," "chambered chills," and specially constructed chills intended to follow the contraction of the roll when cooling have been tried or suggested, but have not met with approval.

The depth of chill on the body of the roll is made to suit the purpose to which the roll is to be applied. If the roll is to be finished plain for sheets or plates, then a shallow chill only is required. If the roll is afterwards to be finished with grooves, then the chill on the body of the roll should be deeper; for such rolls two inches and two and one-half inches depth of chill is sometimes demanded. For large plate rolls, sheet rolls, tin plate rolls and rolls for sheet copper, brass and zinc, the safe depth of chill is embraced between five-eighths of an inch and one and one-eighth inches, but preferably from five-eighths of an inch to seven-eighths of an inch. Users of tin plate and sheet rolls, as well as rolls for copper, brass and zinc, object to unnecessary depth of chill as operating against the strength of the roll, preferring a reasonably shallow chill as giving promise of wearing out. "Better to have a roll to give fair service and wear out than to break with only short use," is their way of reasoning. So, they say when ordering: "Give us five-eighths of an inch to an inch depth of chill and uniform in depth; if it is uniform in depth we will not reject it if it has but nine-sixteenths of an inch depth of chill."

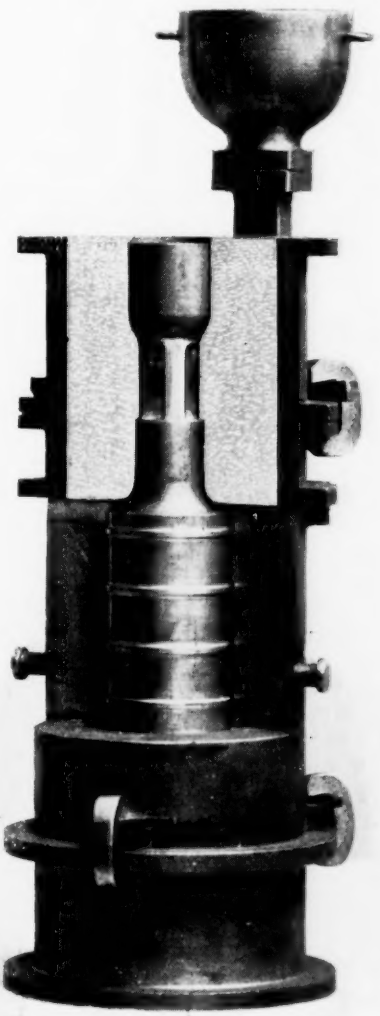
As the strain to which rolls are subjected in service is sometimes very great, it necessarily follows that strength is a most important consideration, and to secure which too great care cannot be taken. None but the very strongest and purest of charcoal irons should be used in their manufacture, and constant and systematic tests and comparisons are essential to secure and maintain a high standard of strength and general excellence.

DEPTH OF CHILL—HOW MADE.

The depth of chill on a roll is a matter that is wholly governed by the mixture of the metals from which the rolls are made. There are chilling irons and non-chilling irons. There are irons that will not chill at all by themselves, but when not too great

* From a pamphlet issued by the Lewis Foundry and Machine Company, Pittsburg, Pa.

a proportion is used with chilling irons, the non-chilling irons will assimilate with them and produce chill. Then there are non-chilling irons that will not only not assimilate properly or readily with chilling irons, but



INTERIOR OF MOLD PREPARED FOR THE "EVEN-DEPTH CHILLING METHOD," SHOWING MOLD AFTER SHRINKING.

will positively retard the chilling of irons which in themselves would readily chill. These latter must be avoided by the chilled roll maker. To make a roll with deep chill, chilling irons only should be used, and in larger proportions as compared with irons which do not chill readily. When excessive chill is not wanted, a less proportion of deep chilling irons will give the result. Usually the strongest irons will shrink the most, but will not always chill well. If the iron used is excessive in shrinkage, then the roll may crack after it is cast and during cooling. The strongest chilling irons which have the least shrinkage are the irons to be used in

making chilled rolls. Charcoal irons, warm blast and cold blast, are the irons which the chilled roll maker must use, for these and these only possess the requirements.

IRREGULAR DEPTH OF CHILL.

Irregularity, or lack of uniformity, in the depth of the chilled surface has long been the fruitful cause of loss to makers and users of chilled rolls. Probably no other cause has led to so many rolls being condemned or replaced by the makers; or so many rolls breaking while in service in the mills, entailing annoying delays and expense. This fault has been attributed to various causes by men of much intelligence and experience. They differ concerning it. Some have supposed that the lack of uniformity in the depth of chill was caused in some manner by the mixture employed; that is, that the non-chilling irons and the chilling irons did not entirely commingle when melted, so that when such a mixture was poured into the mold that a preponderating quantity of chilling iron would swirl to one side of the mold and perhaps a lesser quantity would find its way to the other side, and the result would be a roll that would be irregular in its chill; this theory was wrong. Another opinion held was that irregular, jerky, pouring of the fluid iron into the roll mold, which might happen through carelessness, would cause the molten metal to rise not regularly, as it swirled around the cylindrical chill mold, but in circular waves, or one large circular wave. That is, that each jerk of a badly handled ladle while pouring would cause such a wave, and that this was the cause of rolls having one deep chilled side and one shallower chilled side; or, as sometimes has been the case, two deep and two shallower chilled sides on the same roll. This also was wrong.

THE REAL CAUSE OF IRREGULAR DEPTH OF CHILL.

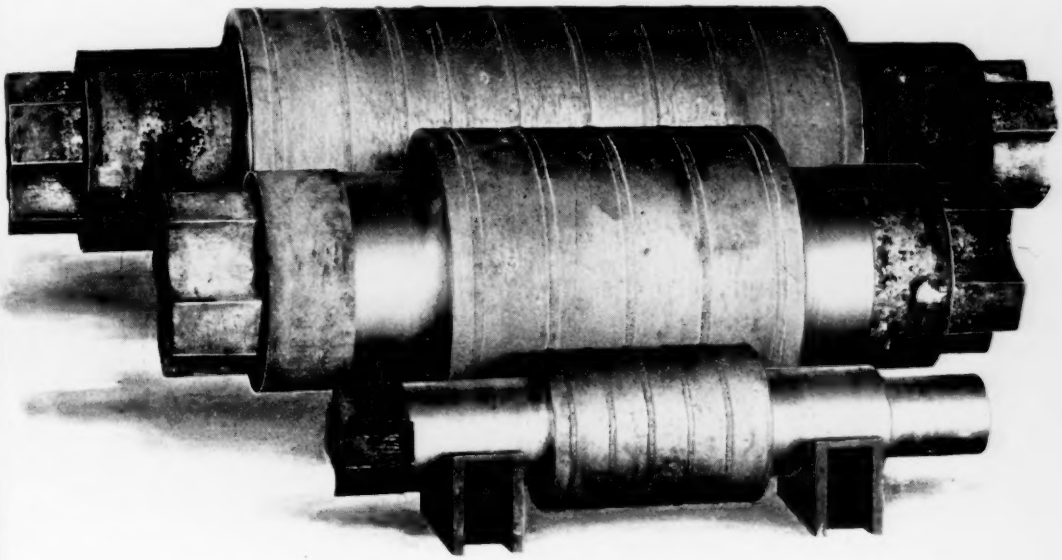
The real and sole cause of irregular or uneven chill on a roll has been established beyond all doubt. First, there was a new theory as to the cause, and that theory was neither of those that have been noted. This final and correct theory had to be tried, proven and again and again proven, and finally established by (to this date) over one hundred and sixty tests. For this number of chilled rolls has been cast by this method begun in May, 1896, and which is in daily practice now at the works of the Lewis Foundry & Machine Co., Pittsburg, Pa., and will be continued as their regular method. The United States patent was allowed in

26x60-INCH CHILLED ROLL, MADE BY THE "EVEN-DEPTH CHILLING METHOD."

November, 1896, and was issued January, 1897, and applications for foreign patents were filed in Canada, England, France, Belgium and Germany, simultaneous with the

American application. By this method rolls having any detrimentally irregular depth of chill cannot be made.

But we shall first endeavor to make clear that which is the sole cause of the lack of uniformity in the depth of chill on rolls. Just as soon as a roll mold is filled with molten iron the operation of casting is at an end, and the cooling and contraction of the roll within begins; soon after the molten iron in the upper end of the mold begins to sink; that is, that surplus portion which is cast on the upper end as a reservoir for the time being and called the "sink-head," and which is afterward cut off. From time to time, as the sinking goes on, fresh molten iron from hand ladles is poured into the sink-head, and thus demand and supply for more hot iron goes on until later, when, as no further sinking takes place, no further hot metal is needed. It is now that the iron is passing from a molten condition to solidification. Of course the whole casting is shrinking within its mold. The length is shortening, and in diameter the body of the roll is leaving the walls of its chill mold. The final and correct theory was that in shrinking the roll body did not leave or depart from the walls of the chill mold equally, but that it would often lean more to one side than to the other—that it would "cleave to one and leave the other." If this was correct, then that side of the chill mold with which the roll body would remain in contact would produce deep chill on the roll, and that side of the roll body which would depart from its chill mold would have a shallower depth of chill. Such was the theory; now for the proof. If all rolls after they are cast—that is, not a single moment later, but from the time that the pouring of the molten metal is ended and shrinkage then and at once begins—could be compelled to depart in shrinking from all sides of their chill molds alike, the molds which form the chill on the rolls would then produce an even, regular depth of chill always, and not result in some rolls having perhaps a half-inch depth on one side and an inch and a half on the other, and which is the very frequent cause of roll breakage by reason of the unequal expansion and contraction, by heating and cooling when afterwards put in use. The chilled portion of a roll does not expand and contract equally with the open gray iron in the interior of the roll.



ROLLS IN THE ROUGH; MADE BY THE "EVEN DEPTH CHILLING METHOD."

No external mechanical means could be devised that would satisfactorily allow or compel a roll when within its mold to shrink away from all sides alike. Whatever means might be resorted to to be effective must be-

gin to act from the precise instant that contraction in the roll casting begins, and should follow it during the period of solidification. The chill on the roll is formed in the earlier part of the period of contraction, and if it is then held centrally within the chill mold, it can in the latter part go as it may, and still not interfere with a uniform depth of chill being formed on the roll.

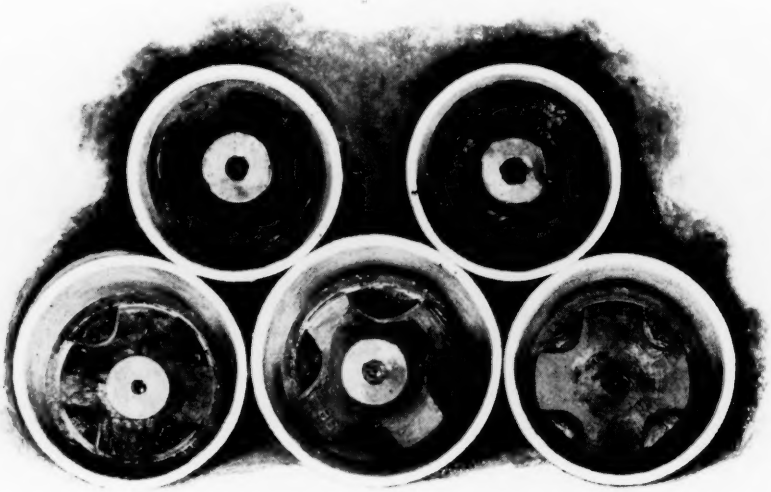
HOW TO MAKE ROLLS WITH UNIFORM DEPTH OF CHILL.

How to compel a roll while in the earlier part of the period of its contracting to remain centrally within its mold, and depart-

beneficial result would be a longer life, a far more satisfactory service, than can be obtained from rolls having an uneven depth of chill.

HOW THE MOLDS ARE PREPARED.

With this object in view, the usual "chills" in which the bodies of the rolls are made had a number of notches or recesses formed on their inner surfaces and near to their upper ends, so that when the cast should be made these notches would form corresponding projections on the surfaces of the roll bodies. These projections were made to have their lower edges beveled or inclined



VIEW OF SINK-HEAD ENDS OF ROLLS SHOWING UNIFORMITY OF CHILL; MADE BY THE "EVEN-DEPTH CHILLING METHOD."

ing, to leave it equally all round, so that during the two, four, six or eight minutes (more or less) in which the chill on the roll is forming, that the roll should be sustained equi-distant at all points from the walls of the chill mold, was the problem. The movement of the roll itself in contracting must do it; this alone could be the proper plan. If this could be done, then the method would be self-operating—automatic; but with the earliest movement of contraction must begin the even departure of the casting, alike from all sides of its mold. With this idea in operation all chilled rolls would be made having uniform regular depths of chill. The

downwardly, so formed by the shape of the recesses that produced them. Now, as the roll made in such a chill mold would begin to sink at its upper end, it would at the same time diminish in diameter; in other words, the roll would leave the walls of its chill mold. When leaving its walls, inwardly and downwardly, the beveled edges of the projections on the body, bearing on the beveled edges of the recesses of the mold, would from all sides compel the roll in shrinking to depart evenly and alike from the walls of the mold toward the centre. These would cause the casting to maintain a central position while the chill on the roll was being

formed during solidification and contraction. After a number of rolls had been successfully made a greater number of these notches were added, so that being closer together more certainty would be established. This was done and the result was still better. Next, if a series of closely formed notches served well, why not make a continuous recess—a small groove around its circumference on the inner wall of the mold? This was done and the ridge or band thus formed on the upper end of the roll body served even better than all else. Now, as long and short rolls are from time to time cast in the same chill mold, why not make a number of small grooves on the inner side of the mold—say from the middle to the top, to form an equal number of ridges or bands on the roll body? This was also done, and the result was a perfect roll. The means here described of supporting the roll during contraction also prevents the rupture or cracking of the surface, and admits of the use of stronger irons, higher in shrinkage than weak irons, hence adding to the strength of the rolls.

Note particularly that any projection that may be cast on the surface of a chilled roll must not project from its body to such a degree as will prevent the chill mold from being lifted up and off from the roll casting, as it stands in the casting pit, after the roll has cooled and contracted within.

As chilled rolls are now made in this improved manner; with a number of ridges, or bands around the surface, these ridges stand out on the largest roll not above three-sixteenths of an inch (3-16 inch) and less on smaller rolls. All rolls so made are of uniform depth of chill, and in addition are very nearly always of the same depth at each end of the roll; not as formerly, always deeper in the lower end of the roll than in the upper or sink-head end.

By a little study of the mold as it has here been described and herein illustrated, it will readily be seen that it would be impossible to make any chilled roll in such a mold, having an uneven depth of chilled surface, for the reason that from the surrounding cylindrical chill mold the contracting hot roll is compelled to depart equally, and at the very instant contraction begins. As it departs the beveled edges on the inner surface of the iron mold, acting on the beveled edges of the ridges on the body of the roll, keep the mold in touch with the shrinking roll until solidification of the chilled surface has taken place, and a surprisingly true round casting is produced which will require, when in the lathe, very little surface cutting to finish it; one-sixteenth of an inch will suffice to make such a roll true.

ADVANTAGES OF UNIFORM DEPTH OF CHILL.

A uniform, regular depth of chill on any roll is a positive merit. If a roll has a preponderance of chill on one side ,there will be unequal expansion and contraction in the heating and cooling when the roll is in use. This will necessarily work mischief sooner or later. The breaking may not take place in the first week or first month of its use, but it will take place. The service of that roll will come to an end sooner than if the chill had been of proper, even depth. If a roll has too great a depth of chill and is irregular, it will break sooner than one of less chill and regular—all else being equal. Why is this?

The reason is simple and plain. Chilled cast iron is crystalline; gray iron is granular. Crystallized cast iron is weaker than gray cast iron. If two pieces of cast iron, one crystal (white), and the other granular (gray), be taken and subjected to continued concussion or vibration, the crystalline will reach its end before the granular. This is for the reason that at the beginning the white iron was by its physical structure nearer the breaking point than was the gray; that is, the piece of gray iron, if subjected to continued concussion or vibration, would have to be subjected a much longer time until the breaking would take place, for the reason that it would have to change from the softer gray condition to the harder white before a weaker state would be reached, but it certainly would be arrived at.

In this matter we have reference to transverse strength of cast iron only, as the subject of this article is rolls, and rolls are never subjected to tensile strain, and only at times to severe torsional strain, but always when in use to severe and sometimes the severest transverse strain.

Then, again, that an uneven depth chilled roll will not roll with thickness the finer gauges of sheets, as will a roll that is regular in its depth of chill, is matter well known to rollers. It is on account of the unequal expansion of the unbalanced chilled and gray iron which forms the body.

Effects of Expanded and Compressed Air in Pouring Molds.

BY THOS. D. WEST.

In continuing the discussion with Mr. Moore, I will first give an extract of the paragraph which constitutes the second point said to be in error, and which reads as follows: "Plain coped work, poured with hot iron, requires less venting than if it were poured with dull iron, as the hot iron has life enough to force the air up through the pores of the sand. If the iron were dull, the compressed air at some spots, not finding as ready relief, would hold back the iron, and by the time the pressure (or the air) escaped, the iron would be frozen, so that when the casting came out, it would show smooth, flat hollows in the cope part. There is very little difference in venting plain copes for heavy or light castings, as regards the closeness of the vents. Light work should be vented to the surface of the mold, so as to allow the air to escape rapidly, while heavy work that requires a pressure of air to keep the cope from being drawn down, should be vented one to two inches from the surface."

The point Mr. Moore would make on the above lies in his saying: "I am convinced that air does not stop the flow of iron; if anything exerts a retarding influence it is steam."

The smooth flat hollows, etc., referred to above are, of course, caused by something. Mr. Moore would say steam was responsible for the evils, while I would define it by the above paragraph as being caused by confined air. Before going further, I would say confined steam could cause the same evils, but I cannot agree with Mr. Moore in saying that air cannot stop the flow of iron. By this, I believe, all will permit me to take it for granted that Mr. Moore will admit that I mean confined air. Now, I certainly do not consider it an error in saying that confined air may hold back the flow of iron. The text-books tell us air is a mechanical mixture of the gases oxygen and nitrogen, 21 parts O. and 79 parts N. by volume, and 23 parts O. and 77 parts N. by weight. The volume of one pound of pure air at 32 degrees F. and a barometer pressure of 29.92 inches of mercury is 12.387 cubic feet. Air expands 1-491.2 of its volume for every increase of 1 degree F., and its volume varies inversely as the pressure. With air at atmospheric pressure of 14.7 pounds per square inch, one pound of air is increased in volume between two and three cubic feet for every increase of 100 degrees F., so that in pouring a mold the heat of the metal entering it must necessarily increase the volume of the air in the mold, just how much will, of course, depend on the shape of the casting and the length of time taken in pouring. In many cases the air can be expanded to such a degree as to increase its volume three to eight times that contained in the mold before the pouring was started, and if this volume is confined it will, in following the above rule, be decreased inversely as the pressure confining it is increased.

By a study of this law it does not require a very great stretch of our imagination to perceive that if it were possible for us to construct a mold so as to make the escape of its confined air impossible, the ingoing metal when pouring would soon have such an air pressure exerted upon it as to hold back the metal from filling the mold perfectly. Of course, this is not a condition met in founding, as all molds must to a greater or less degree permit the escape of the air or gases confined in them, but let us take up phases of the question met with in everyday practical workings, to cite a case wherein confined air is known to hold back the flow of iron. As one example, I would ask how many molders have not found by experience that the pushing up of a vent wire through some little lug or projection in a cope permitted the same to let that part run full and perfect, whereas was not such done the casting might have had to be sent to the scrap pile. Then, again, I would ask if there are not some molders that have found it advisable to carry a small channel or groove from the corner of some part of a mold leading out to the joint of their flask in order to insure a full run castings at such points. A consideration of these two points alone is sufficient to prove that air can be so compressed in a mold as to hold back the free flow of iron. Mr. Moore might try to get back at me by saying it was steam and not confined air that caused the above imperfection in castings. I think a candid consideration of the extent to which air can be expanded by

heat and the fact that an observation of open risers, etc., show that the elements escaping are gases or air and not steam, is conclusive in settling this point. Molders experienced in heavy founding have often witnessed confined air attain such a pressure as to blow the sand or packing out from under riser covers, and I have seen this carried to such a force as to cause the escaping air to make such a roar and whistle as to be heard a good stone's throw away from the shop when the mold was being poured. No, I cannot agree with Mr. Moore that it is an error in my contending that air can hold back the flow of iron.

The question of dirty iron and explosion, etc., as criticised by Mr. Moore, I will discuss in the next issue.

Questions and Answers.

E. C. R. asks us to give him the formula of a compound for follow-boards to take the place of plaster and lime, something that will be light and durable, water-proof and capable of being mixed and poured the same as plaster. (If any of our readers are acquainted with a process that will fill these requirements, we shall be glad to publish the details of same.—Ed.)

J. H. S. writes: I have a large quantity of rolled sheet brass scrap which I want to make into small brass castings, similar to those used on furniture as drawer pulls. I have been putting in about 1¼ per cent of aluminum, which makes it run nicely, but when I remelt the gates they will not run satisfactorily. I can put in one-third of the sprues in a fresh lot of brass, but this will not use up all of them, as the castings are very light. Will you be kind enough to tell me where the trouble is?

(From what you say it is evident that the metal has lost some of its original constituents in melting. In other words, your gates and sprues are of a different composition than the metal charged into the crucibles, caused by the partial loss of some ingredient in melting. As the material you are using carries a large percentage of zinc and as this is easily lost by oxidation, we would advise that you add a portion of this metal to each cast in order to offset the loss. Begin by adding about 2 per cent, and increase until the metal shows its original fluidity.

To prevent the loss by oxidation your crucible should during melting be kept covered with pulverized charcoal as a preventive against the air coming in contact with the metal.—Ed.)

V. W. D. writes: I should like to ask through your journal as to the advisability of coating iron, before casting brass thereon, to prevent blowing. We have had considerable difficulty in obtaining good results. Can iron be successfully poured on brass?

(To the first part of your question an answer will be found in THE FOUNDRY for August, 1895. In addition we note that a writer recently recommended, where the cast iron is to be removed later, to coat it with a covering of asphaltum by dipping it in a bath of that material, afterwards thoroughly drying it.

We have never seen iron cast on brass, and doubt if this can be accomplished where the cast iron occupies considerable volume. Brass, melting at a much lower temperature than iron, could not be protected against the greater heat and would to a certain extent be affected thereby. For light work, however, where the iron congeals almost instantaneously an experiment would soon settle the subject; in fact, we believe that a few simple trials will be worth more to you than all that we could write you on the subject.—Ed.)

Correspondence.

Editor The Foundry:

I have read a statement in THE FOUNDRY, headed "A Novel Use of Cast Iron," and, as the writer seems to think that it has not been thought of before, I wish to state that while I was foreman of the Wabash Foundry, at Moberly, Mo., fourteen years ago, I cast a great many of those tools for the machine shop. Also lately, while I was in charge of John R. Price's foundry, at Monterey, Mexico, I got up patterns and cast a great many down there, and just about three months ago I told the foreman of the Kingsland and Douglas foundry how to cast them. I have got up a good many things in the line of cast iron that I never got any credit for. JAS. GROVES.

St. Louis, Mo.

One chief reason why the originator sometimes fails to receive the credit due him for the introduction of new processes is the desire to surround his discovery with a certain amount of mystery in an attempt to withhold the benefits arising from the rest of the world. In publishing the above item we neglected to give credit to any particular individual, for the reason that nobody claimed the honor in any of the information we had been able to gather upon the subject.

The letter from Mr. Thos. Wathey, published elsewhere, bearing on the same subject, may interest Mr. Groves, as tending to show that the process is more than fourteen years old. It may be possible that in this case, as it often happens, the same result is arrived at by different individuals acting independent of each other. One thing is certain, we are willing to give credit to all who claim the honor. We know that many "kinks" inaugurated in the foundry, pass as the offspring of some one else besides the real discoverer. We have not got credit for everything we have done ourselves, either good or bad, and the last thing we would think of would be to inflict the same cruel punishment on a fellow craftsman.

The lesson should be learnt, however, that if one has got a good thing he should push it into THE FOUNDRY and get the benefit accruing from a judicious advertisement of his ability. If Mr. Groves had handed this item to us we should very much have preferred to have obtained it in that way, and he would at the same time have shared some of the joys that fall to those who discover things and are liberal minded enough to tell how it was done.

If we could produce as much discussion on any problem by simply omitting to mention the author's name as we have succeeded in doing in the present case, we should feel tempted to repeat the experiment. A difference of opinion—something to talk about—is what we are after, and there seems to be more in this item than we originally thought. —Ed.)

Editor The Foundry:

I was much interested in the answer of Mr. West to Mr. Moore in February's issue of THE FOUNDRY on "Feeding Heads," "Risers" and "The Drawing Down of Green Sand Copes."

When we see a casting that has drawn down most molders seem to understand what has happened and know how to remedy by nailing or drying such as Mr. West speaks of; but whether they understand the real cause or not is a question. It has often occurred to me that "draw down" is a wrong term to use, as it would lead one to believe that molten iron has some magnetic force which pulls down the sand from the surface of cope. It seems to me it is nothing more or less than expansion of water or gases which press off the piece of sand, and is no more a draw down than a scab on the lower side is a draw up, and could more properly be called a scab on the cope.

By covering the feeding heads and risers and keeping the gate full while pouring the expanded air is kept confined (except as it works through the sand and vent holes), and forms a support under the cope which tends to overcome the pressure of the steam and gases on the surface of the cope.

Mr. West says, in regard to drawing down: "This is caused by the sand exposed to the heat beginning to dry and dropping down on the rising iron, which, when the casting comes out, shows lumps and sand holes in the cope part."

It has been my experience that sand "beginning to dry" may be pressed off the face of the mold by steam, but not because it is "dry." If Mr. West means burned instead of dry, I would say that burned sand crumbles and would not give the appearance of a draw down, which generally presents itself immediately below the surface of the casting after chipping off the scale of iron covering it.

JOHN W. HUGHES.

Chicago, Ill.

Editor The Foundry:

Seeing an account in the February edition of THE FOUNDRY regarding tools or cutters made of cast iron, used in the Pennsylvania railroad shops at Altoona, puts me in mind that we used to make tools for roll turning in the old country thirty years ago. When I came to this country (soon after that time), I worked in a foundry where they made a large number of old pipes and turned off each end. The man that was doing the job used to be grumbling constantly about the steel that he had to use. He said it was no good. So I said: "Why don't you get some

cast iron tools made. They will do the job for you," and the man laughed at me. "Well," I said, "if you will make a pattern of what you want, I will make you some and will guarantee that they will do their work." With a great deal of persuasion he made a pattern, and as they were making some small car wheels at that time with about a quarter of an inch chill, I made him the castings, and he was well pleased with them and would not use the steel afterward. Not long ago I was passing through a machine shop and heard a squeaking noise, and, looking around, found that it came from a lathe the man was trying to turn up a pulley. It was hard and the tool would not touch it, so I asked him if he ever used cast-iron cutters, and he said he had not and did not believe they were any good. He said that he had worked in some of the best shops in the country, but had not seen cast-iron tools used in a machine shop yet. I asked him if he would try one if I got it for him. He said he would. So I went over to the foundry and brought a piece that I had made for a trial piece to see what amount of chill was on it. It was about three-quarters of an inch square and seven inches long—just the right thing. So he put it in the lathe (after he had ground it), and you never saw a more surprised man than he was, as he remarked, "Well, I should never have thought of that."

THOS. WATHEY.

Cleveland, O.

Editor The Foundry:

In the February issue of THE FOUNDRY, Mr. Thomas D. West, replying to Mr. Robert D. Moore, among other things, mentions that he recently saw, in the American Machinist, the statement "that when casting a plate two inches thick the cope will be baked as hard as a brick before the iron strikes it. And he only wished it was so," etc.

I am of the opinion that was an assertion of mine, metaphorically speaking; at least it sounds like mine. It is one I have made to a great many molders, as an evidence that plain copes need no venting.

"Hard as a brick" was intended to mean dry, that is, the surface of the sand that the iron would come in contact with would be baked dry, and if some cohesive substance, as clay wash or molasses water, was sprinkled on the cope portion of the mold it would be baked hard and dry with two inch thickness of hot metal; that is, a casting that thick while filling the mold. That was my judgment then.

Since reading Mr. West's very able and entertaining article in your February number, I have given that particular subject, i. e., "How much does the cope get dried during the filling of a mold two inches thick," a practical demonstration.

I took a pattern that was 12"x12"x2½" and made an ordinary mold, same temper of sand as usually used in green sand practice. Did not wet the cope with anything; gated an outlet to show when mold had two inch thickness of metal in it; then removed the cope instantly, and cut the sand away at right angles to see how deep it was dried. It showed just one-quarter inch of dried sand, absolutely bone dry. It took just thirty seconds to fill the mold two inches deep with hot iron.

I think I shall continue to make the same claim, that a mold of two inches thickness, and if thicker, say four inches, six inches or eight inches thick, will be dried (perhaps "hard as a brick" don't just express it), but bone dry will be the surface of the cope when the liquid iron reaches it. By putting in flour, clay water, molasses water, etc., it will be on the surface very much like a brick in hardness. I never would dry the cope before closing over a thick piece. It would seem to me like labor lost.

In this section we have made hammer blocks four feet and five feet square, some thirty-six to forty inches deep, in green sand, cope and all—and it was not considered much of a trick to so prepare the cope that it would not draw down, or, in other words, scale off by the heat; never heard of drying all prior to closing mold. The kind of sand used here comes from near Albany, N. Y.

Boston, Mass. L. C. JEWETT.

Editor The Foundry:

Since writing you last I have made another practical demonstration that a cope gets hard baked if covering a two and one-half inch thickness of casting, while metal is filling the mold; and if the sand is properly prepared, or prepared as mentioned in the February Journal (by Mr. West) the surface that the iron strikes will be baked dry, and

for one-eighth inch deep will be hard as a core, or, metaphorically, hard as a brick.

I had a pattern molded 12″x12″x3″, with an outlet cut so the hight of metal could be seen before touching the cope. The sand was taken bone dry and one part of flour to sixteen parts of sand was well mixed together and then tempered or wet to temper with returns or sour beer. Gaggers, well clay-washed, were placed on sand one eighth of an inch deep, and the cope rammed good and snug. No vents were allowed in the cope, it being well sprayed with sour beer with an atomizer and then closed. It was gated so it filled in just fifty seconds to within one-half inch of the cope. Stopped pouring and removed cope instantly, and found the surface that the iron would have struck dried to one-eighth of an inch in depth, and AS HARD AS A BRICK. You will please note that the iron did not rise within one-half inch of the cope. If it had, it would have dried deeper in, but it could not have been any harder on the surface. One of the laborers, standing near, when it was found baked hard, said: "Begorra what wold it do?" Yes. What else would it do? I ask.

Boston, Mass. L. C. JEWETT.

A Correction by Thos. D. West.

In the January FOUNDRY, Robt. D. Moore criticized some paragraphs in West's "American Foundry Practice," among them being one in which Mr. West is credited with saying that grey iron melts easier than white iron. It appears that this error is found in the earlier editions only. Mr. West has forwarded us a copy of a letter sent by him to the publishers two years ago, in which he directs them to correct the item to read, "White iron passes from the solid to a liquid state far more readily than grey iron." It may be added that this view is held by Mr. West and is expressed in other parts of "American Foundry Practice," showing that the author never intended to convey any other meaning than that white iron melts the easiest. As Messrs. Moore and West were consulting different editions they were of course unconscious of the cause of the seeming disagreement, which helps to illustrate that the path of him who writes is not always smooth.

CAST IRON NOTES.

Devoted to inquiries from Practical Foundrymen on the subject of Melting and using Cast Iron. Address all Inquiries to W. J. KEEP, care of The Foundry.

Best Iron for Grate Bars.

I am asked what mixture of iron will make the most durable grate bars. Grate bars are usually made from rather hard iron, probably because scrap and cheap pig iron are supposed to be good enough for this purpose. It is, however, not improbable that iron higher in silicon would do better. At one time I tried malleable iron for stove linings, and at another time linings made from melted malleable iron castings. Both burned out much more quickly than linings made from soft pig iron.

Molding Sand.

I have received a sample of sand with a request for an opinion as to its quality. The sample contained so much clay that it was wholly unfit for use as a molding sand; more than one-half seemed to be clay. A molding sand should be composed of about ninety parts of silica sand, and about six parts of alumina, to bind the particles of sand together. The silica is very refractory and cannot be melted by the iron, but without a binder it would not make a mold of sufficient strength to contain the melted iron. Alumina is the best binder, and there should be in the sand just enough to give strength to the mold. More than this will decrease the refractoriness of the mold. Magnesia is a good binder and is refractory, but it lessens porosity and is therefore an undesirable element. Porosity is very essential in a mold. The sand must be somewhat moist, and the evaporation of this moisture into steam, together with the air in the mold, and the gas formed by the burning of bits of roots and sticks in the sand, and the gas which forms from metallic oxides which are always present, must be able to escape as fast as the mold fills with iron. It is better for these gases to escape through the walls of the mold than to provide an opening for escape. Iron will lie against the walls of the mold better if the sand is open enough to allow the gases to

pass away from the iron as it fills the mold. To cause the gases to take a course away from the iron, not only must the sand be open, but passages for escape are made nearly to the wall of the mold with a vent wire, and sometimes loose material, such as broken coke, is placed in the sand to allow the gas to escape through the more open grain.

Lime is a very undesirable element in molding sand, but some is always present. Lime, silica and alumina form together a fusible slag, though neither can be melted alone. Silica and alumina in a good molding sand are necessities, but if lime is present at the same time a portion of each will melt and adhere to the surface of the casting as a hard skin or scale. The hotter the iron, the more will burn on. This is the origin of scale on castings. Mica is very refractory, and some of the best molding sands contain small glistening particles of mica.

It is not the finest grained sand that will make the smoothest casting. The sand must have sufficient vent to allow the iron to lie against the wall of the mold, and be refractory enough not to burn into the surface of the casting. If burned sand is removed, the imprint of each grain will show on the surface. Hard ramming in any one place may prevent the iron from lying close to the sand, and thus cause the casting to have an uneven surface.

The bank from which molding sand is taken contains various layers and pockets of different grades; coarse, open sand, suitable for molding heavy machinery, fine sand, suitable for stove-plate, and still finer sand for brass castings. Silica sand without any cementing material is also found in the same bank.

The one in charge of grading and loading, separates each grade from the others and ships each founder sand of uniform quality, suited to his special requirements. Machinery sand and stove-plate sand are each graded according to coarseness into No. 1 and No. 2; or the numbers may run from No. 1 up, so that fine stove-plate is No. 5. Molding sand is obtained at various points near Albany, at Crescent, and around Waterford, in New York. An analysis of No. 1 stove-plate sand from Crescent showed 80.99 per cent silica, 4.49 per cent alumina, 3.92 per cent oxide of iron, and 0.61 per cent lime. Sand very similar to this, but generally of a coarser and more uneven grain, is found on the southern shore of Lake Erie, near the line between Pennsylvania and Ohio, and a similar sand, but of finer grain than Albany sand, is found at Newport, Ky.

Albany sand has rated as a very superior molding sand for more than half a century. Molding sand can generally be found near each foundry, but if such sand contains too much alumina, an even-grained silica sand, with the grains the same size, can be mixed with the molding sand, so as to bring the proportion between silica and alumina as near 90 and 6 per cent as possible. If the sample sent me, which suggested these remarks, is the best that can be procured in that locality, find a similar silica sand and mix in a little at a time until the right proportion is found. Such artificial sand generally resists the iron fully as well as natural molding sand.

Philadelphia Foundrymen's Association.

The sixty-fifth meeting of the Foundrymen's Association was held at the Manufacturers' Club, Philadelphia, on Wednesday evening, Feb. 3, and was very largely attended. President Wanner occupied the chair.

It was not deemed advisable to establish a credit system, but the meeting concurred in a resolution which had previously been passed by the executive committee, as follows: "That the members of this association should feel at liberty to seek any information either through their fellow members or through the medium of the secretary. In other words, should a member of this association feel that he is being imposed upon by a customer who has exhausted his credit and gone to another foundry to draw his supply, he can procure certain information in this way. The nature of this association is to a certain extent protective, and those who join do so for the purpose of improving their condition. We trust therefore the members will appreciate this fact and assist each other as far as possible in matters of this kind."

George W. Moore then exhibited

A PATENT CUPOLA BREAST,

whose workings he explained. He said:

"I have here a time, labor and money-saving device, in the shape of a cupola and furnace breast. A breast is a very important

factor in the transmission of iron, yet one of the smallest considerations in its manufacture. This breast is to do away with the old style clay breasts, which have always been a source of annoyance to foundry foremen, not only by their having to put in a new one for every heat, but sometimes before the heat is completed. With this breast there is no cause for anxiety. When properly placed the heat can be run with uniform flow, until the supply is exhausted; and can be stopped off when necessary by a stopper of the same material, which does away with the use of clay plugs and tapping bars.

When dropping the bottom you always close the tap hole. When slag accumulates it can be easily removed, as it will not adhere to the breast. By careful manipulation this breast will last from three weeks to three months. Care should be exercised in its adjustment. Place the breast within one inch of the inside of cupola, and after the blast is started, keep the top hole closed until sufficient iron is melted to rise above it.

"In regard to the tap hole, you regulate that accordingly. A ½-inch hole will run five tons per hour, a ⅝-inch hole 10 tons, and a ¾-inch hole about 15 tons. This breast has been tested by all kinds of metal, and has proved successful in all cases.

"I have used the breast for Stanley G. Flagg & Co. in both cupola and furnace for the past year, and have seen all effects and changes that the molten metal will produce in the breast."

Mr. Moore was followed by Mr. James Christie, of the Pencoyd Iron Works, Philadelphia, who read the following paper on the

DROP TEST FOR CAST IRON.

"The object of these few remarks before the practical men who compose the Foundrymen's Association is to impress on them the value of the drop test, as a simple method and one quite readily accomplished, for determining the most desirable resisting properties of cast iron. To make a complete study of the subject, the testing room should be equipped so that tension tests, transverse pressure tests and transverse drop tests can be made on standard specimens. The chemical analysis of each should be recorded, also a record of shrinkage and other physical properties should be tabulated, but however desirable all this is, it is too much to ask of the overtaxed foundryman, who prosecutes his business in a humble way. Let us be satisfied to ask him for one test that can be readily obtained with inexpensive devices, but insist that this one test will afford the best criterion of the suitability of the metal for its intended purpose.

"The effects of impact or percussion and shock are the most destructive forces materials have to endure. They are rarely absent in any service to which iron is subjected, and cast iron is the most treacherous form of the metal, and the most variable in its resistance to dynamic forces. Therefore, the material that offers the most effective resistance to the fall of the drop will probably represent the metal most generally useful for the manifold purposes in practice.

"It is generally recognized that high tension alone is not a safe guide, and it has become customary to rely on transverse strength and deflection as obtained by static pressure as a surer exponent of the resisting qualities of the metal. In the early experiments of Hodgkinson he assumed, on what appears to be insufficient evidence, that the breaking load multiplied by the maximum deflection of the specimen afforded a comparative estimate of its resistance to impact. There are reasons to believe that static stress of any kind and for any class of iron is not always a correct indication of its ability to withstand dynamic forces. A well-known illustration of this appears in high phosphorus steel, when the metal may yield satisfactory results in the static test, but is dangerously brittle when subjected to sudden impact or percussion. There are reasons to believe that this is frequently true also for cast iron, and the writer hopes at some future time to present some experimental data on the subject, but which is not in proper shape for presentation now.

"For drop testing it is proposed to use test specimens of a standard dimension and placed on supports a standard distance apart, as in the pressure test, and subject them to the action of a falling tup of a standard weight, and striking the specimen exactly in mid-length, similar to the well-known test for axles, rails, etc., but on a smaller and perhaps more precise scale. The blow should be begun well below the breaking point, and the height of fall gradually increased until

the specimen breaks, the deflection for each successive blow being recorded.

"The device required for testing is of the most simple character. A bed-plate bearing supports for the specimen, and carrying a pair of vertical rods, on which the tup slides, all surmounted with a lifting attachment for raising the tup and a trigger hook, which permits an instantaneous release of the tup. A rigid pencil attached to the tup will record on a tablet the amount of deflection, although the determination of deflection is not so important with the drop test as it is with the pressure test. For specimens one inch square and 12 inches between supports, a weight of 200 pounds falls approximately three inches to break ordinary cast iron, so it will be seen that the apparatus required is quite small and inexpensive.

"These suggestions are offered as aids, not hindrances, to the successful operation of the foundryman who does not use his own castings. For the more intelligently he uses his material the better the satisfaction to the customer and the higher the place occupied by his business in the industrial arts. There is a more general tendency, nowadays, to adopt some special method for testing. The pressure test is the one generally demanded by the government. Pressure tests, however, are not sufficient indication of the ability of cast iron or any metal to withstand a blow. There are a number of instances of deviation. The drop test is the surest guide and best criterion of the useful properties of cast iron. A 225-pound weight is the one I use in the drop test."

Mr. Schumann: "I concur with Mr. Christie fully. My observations are that any part of a machine that gives way gives way under a blow. It may be one heavy blow or a multiplicity of light ones. I have known a pulley or heavy shear to break under a blow. I always work to have the impact test used for cast iron. I have seen two castings made of the same material, and have found that one cooling slowly will sustain a greater impact than the other cooling quickly. Any machine is subject to injury from impact at any time."

Asa Whitney: "Here is an interesting thing that may be news to you. The Pennsylvania Railroad has recently decided that the thermal test is the best for car wheels, and all their specifications provide for that. The wheel to be tested is laid flat in a sand mold, and hot metal is poured around it. The wheel that stands the test without breaking is considered a good wheel and is accepted."

Mr. Davis: "I would like to ask Mr. Christie whether the hexagonal or round test-bar could be used as well as the square one he mentions?"

Mr. Christie: "Any bar would do."

Mr. Flagg: "Do you record the deflection and set, or simply the deflection?"

Mr. Christie: "Simply the deflection."

The following letter bearing upon the apprenticeship question was then read:

"Drifton, Pa., Feb. 1, 1897.

"Gentlemen:—In answer to the question, 'Are apprentices of any advantage at all to foundrymen?' I would say, Yes. I find with us here at Drifton the only way to get molders is by apprenticeship, and after three months these young apprentices become valuable. By taking pains with them they can do the ordinary molding after six or eight months, and at the end of two years they become very proficient in their work. At the end of the fourth year they do very good molding—this is, on general work.

"My experience in regard to this for the past ten years in the foundry, machine, boiler and car shops is that the only way to get molders or machinists to do the class of work is to bring them up with your business, and you will get good results from your apprentices. I also find that those apprentices who attend night school make the brightest and best molders or machinists, and those that do not take a liking to school only make ordinary molders or machinists.

"We have with us here at Drifton 44 apprentices in our different shops, and I find them all useful young men. I do not think that the trade school can turn out as good a molder or machinist as an apprentice brought up and who has learned his trade in the machine shop; as they do not have the opportunity in the trade school to observe the different classes of work which may be going on as they have by being apprentices in the shop where they can readily see how it is done from observation while at some other class of work. Yours truly,

"JOHN ROHLAND,
Supt. Coxe Iron Mfg. Co."

Western Foundrymen's Association.

The regular monthly meeting of the Western Foundrymen's Association was held Wednesday evening, Feb. 17, at the Great Northern Hotel, Chicago. The president, A. W. McArthur, was in the chair.

The business in order was the discussion of topical question No. 8, which reads as follows: "What is the proper amount of air, and pressure of same, to melt iron in cupola, and what are the effects of too little and too much air?"

Mr. Sorge: In the proportioning of tuyere areas for cupolas and the size of blower necessary, the ordinary practice is to assume a consumption of 2,500 pounds of air for 2,000 pounds of iron melted. This is on the assumption of about 8-ounce blast pressure and a melt of 7 pounds of iron per pound of coke.

Mr. Smith: As to the exact weight and pressure of blast required in a cupola, I have no actual figures, and I believe that any figures assumed are merely theoretical. My experience is that 8 ounces is about the best blast pressure. In one foundry with which I was connected, we used a No. 7 Sturtevant fan running at 2,200 revolutions, but a No. 8 fan running at 2,000 revolutions, or a No. 9 fan running at 1,900 revolutions, would accomplish the same purposes. Too little blast does very little harm, but too much blast is liable to do considerable harm. Particularly is this the case at the beginning of the heat, and especially with soft iron. Excessive blast melts faster, but produces colder iron and has a tendency to harden same. My experience is that the iron coming from the cupola is usually hard at the beginning of the heat and gets softer later, even where the same charges are used right through.

Mr. Pettigrew: For many years I used a 48-inch cupola which had eight 5-inch round tuyeres and used a No. 7 Sturtevant blower running at 2,300 revolutions, producing a blast pressure of 9 ounces. My experience is that when the cupola is dry and in good shape the iron is softer at the beginning of the heat. In car wheel foundries where heats of 36 to 40 tons are taken off they charge more hard iron in the middle of the heat than either at the beginning or at the end.

Mr. Dalton: In my experience I have seen cold iron come at the first tap of the cupola while the iron became hotter as melting continued. I believe, however, that this was due more to the condition of the cupola than to the amount of air used.

Mr. Smith: The iron in the cupola trickles through the charge in a similar manner to water trickling through a sponge, and when an excessive amount of blast is used, the iron is exposed to the action of the oxygen in the air and there is a tendency of hardening the iron by burning out some of the silicon. I have also found that an excessive amount of air chills the charge at the opening of the tuyere, thus preventing good circulation of the air through the charge in the cupola, and consequently also preventing thorough melting.

Mr. Coffeen: I have had some experience with the melting of iron for car wheels. Where I worked we found it necessary to use more softener at the beginning of the heat than later, as we invariably had harder iron at the first tap than at subsequent ones.

Mr. Hanna: We have a 32-inch, a 40-inch and a 60-inch cupola. We use 15 to 16 ounces blast. In the 32-inch cupola we melt about 4 tons per hour, in the 40-inch about 6 tons per hour, and in the 60-inch about 12 tons per hour. Into the 32-inch cupola we blow 3,520 cubic feet of air per minute. Into the 40-inch cupola we blow 5,480 cubic feet per minute, and into the 60-inch cupola we blow 7,920 cubic feet per minute. The 32-inch cupola runs on hard iron for chilled work. The other two run on gray iron. If 2,500 pounds of air melts 2,000 pounds of iron, we are using a very excessive amount of air.

Mr. Ferguson: I cannot tell just what the quantity of air is that should be used, but I know that I use as much air as I possibly can. I never had too much. It may be that the engineers in designing a plant so proportion the blowers that we could not get an excess, but, up to the limit of the blower capacity, I want all the air that can be obtained. As I increase the amount of blast, I find that I increase the speed of melting. I find that our iron is harder at the beginning of the heat than later, and I know that car wheel foundries have the same experience.

Mr. Smith: Mr. Ferguson's class of work and mine are very different. He makes heavy gray iron castings, while I make very light work. This may possibly explain why our experience varies.

Mr. Dalton: I find that we never get too much air and I need very hot iron to do the work in our foundry. But my experience shows that I get cold iron with too little blast.

Mr. Ferguson: About ten years ago I experimented with low blast pressure to my heart's content. In a 30-inch cupola with 8 ounces of blast, I melted at the ratio of 1 to 7, my heats being from 3 to 5 tons easily. I reduced the blast pressure daily and also the amount of coke until I melted with a 4-ounce blast and the ratio of 1 to 11½. I then stopped, as I found that my iron was growing too cold.

Mr. Sorge: When the blast pressure is reduced the volume of air should be increased and therefore the area of the tuyere openings into the cupola should be correspondingly increased. It is my opinion that the blast pressure employed by Mr. Hanna is too high for economical results, and that he would do better by using a lower pressure and increase the amount of opening into the cupola through which the air is introduced. Where the air issues into the cupola under a very high pressure and through a comparatively small tuyere area, it acts upon the fuel something like a blow-pipe, produces intense heat at one spot and burns away the coke rapidly, thus leaving holes through which afterwards the cold air enters and thus reaches the center of the cupola. In my opinion a large volume of air with low intensity of blast is preferable to a small volume of air with high intensity.

Mr. Thompson: I find that one difficulty in judging of the air pressure is that the blast gauge does not tell the story unless you use a positive pressure blower. Where a fan is used the amount of air delivered is not a positive quantity. We have a 54-inch Colliau cupola lined up to 48 inches. With a No. 6 Root blower delivering about 46 cubic feet per revolution or 8,000 cubic feet per minute, we melt from 12 to 13 tons in a heat and use about 40,000 cubic feet of air per ton. We consider this a rather large amount. We get no colder or hotter iron by using more blast, but my experience is that we simply melt faster.

Mr. Carter: I am not a foundryman and am not familiar with cupola work. However, I have gone over some of the figures given, and I do not find a very great difference. Mr. Sorge thought 2,500 pounds of air per ton of iron is used, Mr. Thompson's figures show that he used about 3,000 pounds. Mr. Hanna shows that he used about 4,000 pounds of air for a 32-inch cupola, about 4,100 pounds for the 40-inch cupola, and about 3,000 pounds for the 60-inch cupola. There is therefore very close agreement in these figures when you consider the difference in blast pressure employed.

Mr. McArthur: It appears to me that the amount of air needed for melting depends largely upon the character of the fuel employed, and I should like to hear from some of the members on the subject.

Mr. Jackson: I think the physical structure of the coke used in melting iron has considerable to do with the quantity and intensity of blast employed. Where the coke is soft, less blast pressure is needed and a greater volume than when the coke is hard. This will then necessarily involve a larger tuyere area for soft coke than for hard coke.

Mr. Hanna: I do not think a fan can be relied upon for cupola work, but that a positive pressure blower is needed. The best results that I have obtained were with a 30-inch cupola, having a 2-inch annular tuyere extending clear round the cupola and in which I used 10 ounces blast pressure and melted 5 tons per hour. I believe that low pressure and large volume of air are desirable when the cupola can be so constructed as to get sufficient tuyere area. There are practical difficulties about getting a sufficiently large tuyere area.

Mr. Ferguson: They tell us that theoretically we should melt 20 pounds of iron to one of coke, but actual results show that on the average we do not exceed 8 to 1. Does this not show that we are not getting enough air?

Mr. Sorge: I hardly agree with Mr. Ferguson in this proposition. The small proportion of iron melted per pound of fuel is due to the fact that, after the fuel is consumed in the melting zone of the cupola, the gas passes up through various layers of fuel and the carbon dioxide which is the product of perfect composition is transformed into the carbon monoxide by the absorption of more carbon. The heat value of this carbon monoxide, or in other words, the amount of heat produced by burning of the fuel improperly is very much smaller than that produced by

burning the fuel perfectly and forming carbon dioxide. In other words, we are getting in the cupola imperfect combustion and are permitting a large portion of the heat value of our fuel to pass out of the stack. This is the reason why the amount of iron melted in the cupola is so much smaller than theory tells us should be the case.

Mr. Hanna: I think that usually it is more economical to sacrifice fuel in order to save time and other expenses running the cupola.

Mr. Carter: I have made a few more figures on the cupola mentioned by Mr. Hanna. In the case when 4,100 cubic feet of air were consumed, I find that there were about 20 pounds of air used per pound of carbon in the fuel, while they were melting at the ratio of 10 to 1. The theoretical consumption of air would be 13 pounds per pound of carbon.

Mr. Ferguson: I believe we need more air in our cupola, and think we should therefore have larger blowers and more tuyere area.

Mr. Pettigrew: I regret that Mr. Moore, of Joliet, is not here, as he has had experience in this line which is very interesting. He has a Colliau cupola which was fitted with the usual tuyeres. He formerly used Connellsville coke entirely. During the strike in 1887 he had great difficulty in getting his coke and finally was obliged to purchase coke of a different character and what he considered of inferior quality. He was unable to melt his iron properly, but he finally took out the Comau tuyeres and cut out large openings, simply increasing the tuyere area in his cupola. He reduced his blast pressure and increased the volume of air and since then he has had no trouble whatever to get hot iron in good condition from soft coke.

Mr. Jackson: I believe that one difficulty is that foundrymen are frequently not accurate enough, not knowing the conditions under which they work. Some time since I met two foundrymen running cupolas under like conditions and fitted with the same kind of apparatus. I asked one what blast pressure he used. He stated that he did not know, but that he ran his gauge up to 2 inches, which he thought was about 13 ounces. The other had the same kind of gauge, cupola, etc. He told me that he ran his gauge up to 2 inches and that his pressure was 8 ounces. I only said this to illustrate that frequently foundrymen believe that they are working under conditions different from what actually exist.

New England Foundrymen's Association.

The regular meeting of the New England Foundrymen's Association was held at the United States Hotel, Boston, February 10. After the business of the evening had been transacted the vice-president, Walworth O. Barbour, furnished a paper on what methods should be pursued to further the interests of this association, and to make it a source of definite profit and pleasure to its members, which was discussed by those present.

Obituary.

Samuel R. Wilmot, president of the Wilmot and Hobbs Rolling Mills Company, of Bridgeport, Conn., died suddenly on Feb. 4, of heart disease at his residence, aged 68.

Mr. Wilmot was a native of England but came to this country with his father, when 7 years old, and settled in the west. From there the family went to Canada. In 1861 Samuel Wilmot, with his brother William, and the late D. W. Kissam, began the manufacture of brass goods in Brooklyn, N. Y., and four years later they came to this city and organized and incorporated the Bridgeport Brass Company, which is now one of the largest concerns of the kind in the country.

Mr. Wilmot retired from the company some years later, and in 1877 organized the business which he was president of at the time of his death.

Maj. Thomas B. Griffith, a well-known Grand Army and business man, died in Boston, Mass., of consumption. Deceased was born in Carver and was 73 years old. When a young man he followed the sea, shipping on a whaler from New Bedford. He afterwards made several trips round the world in a merchantman. On his return to his home in Carver he started a foundry business, and was at the time of his death president of the well-known Murdock Parlor Grate Company, manufacturing in Middleboro, with offices in Boston and other large cities.

John Torrance, the veteran iron founder and old citizen of La Crosse, Wis., is dead. He was born on January 1, 1833, in Lanarkshire, Scotland. In the city of Glasgow, he received his schooling and there learned his trade, that of iron molder. Emigrating to the United States in 1852, he located in Troy, N. Y., remaining there six months. From Troy he went to Delhi, N. Y., thence back to Troy, and after two years there, removed to Paradise, Ky., where he worked at the trade until 1858. Pushing on farther west, he located on a farm in Houston county, Minn. The next season, Mr. Torrance came to La Crosse; he entered the employ of Leech & Paul, then the leading iron founders, and speedily, through his superior ability, worked his way up and into the foremanship of the concern. In 1862, Mr. Torrance ventured out into the business world for himself. Associated with Archibald Gould, under the firm name of Torrance & Gould, a foundry was established at the foot of State street. The fire fiend swooped down upon the prosperous little business in 1865, and destroyed the foundry, a frame structure. Mr. Torrance again entered the employ of Leech & Paul, then later was with C. C. & E. G. Smith and Thornley & James. In 1876, in company with his son, Alexander William Torrance, he established the present business, now located at 114-116 Jay street, which, guided by Mr. Torrance's experience and business qualifications, now ranks among the leading foundry and machine shops in the city.

Otto Mellert, the well-known Common Councilman of Reading, Pa., representing the Fourth ward, died at his residence, 222 South Sixth street, in that city, recently, of liver complaint and dropsy, followed by heart failure, aged 67 years.

The deceased came to this city with his parents from Germany when 5 years of age, and lived here ever since. He was the son of John and Catharine Mellert (both deceased). His father was one of Reading's early iron men and founded the business of the Mellert foundry. He attended the schools of this city and when quite a young man entered the shops of his father and learned his trade as a molder. He mastered all the details and became very proficient. He worked at the trade some years, when he took charge of this department as foreman and held the position until 1880. At that time the business of the firm was reorganized and assumed by the present management, and Mr. Mellert resigned. Recently he has been a pipe inspector in New Jersey. He was an active Republican, and was serving his second term as a member of the Common Council from the Fourth ward.

Mr. George W. Hardesty, who formerly conducted a brass foundry on Holliday street, Baltimore, Md., died Feb. 2, at his home on Loney's lane, Baltimore county, of pneumonia, aged 67 years.

Conntcil Munson, of the firm of Munson Bros., mill furnishers and founders of Utica, N. Y., died on Feb. 12.

Frederick P. Miles, who, in partnership with his brother, E. M. Miles, owned the iron works at Copake, N. Y., died on Feb. 19, of Bright's disease.

Sherman Skinner Jewett, the well-known stove manufacturer, and member of the firm of Sherman S. Jewett & Co., Buffalo, N. Y., died at his home on the 28th ult. He was born in Moravia, N. Y., on January 17, 1817. After a district school education and a brief apprenticeship in a country store, Mr. Jewett, in 1834, went to Buffalo and accepted a position in the foundry of his uncle, where he learned the molder's trade.

In 1836 Mr. Jewett started in for himself, having an interest in the firm of Day, Root & Co. Mr. Jewett's associates were Franklin Day and Francis H. Root. Within a few months after starting the firm name was changed to Skinner, Root & Co., Mr. Skinner, Mr. Jewett's uncle, having bought Mr. Day's interest. The next change took place in 1838, when Messrs. Skinner and Root retired, and Mr. Jewett took Thomas J. Dudley into partnership. At the expiration of two years Mr. Dudley withdrew and Mr. Jewett continued the business alone until 1843, when he associated with himself his original partner, Mr. Root. The firm thus reorganized under the name of Jewett & Root, continued without change in its personnel until 1875, when Mr. Joshua Root was admitted. The firm's business was now limited to the manufacture of stoves and expanded rapidly. In 1854 the increasing demand led to the establishment of a branch at Chicago, and, at later dates, at Milwaukee, Detroit, San Francisco, Cincinnati, Portland, Boston and Denver.

In 1878, after thirty-five years of association in the enterprise, the two old partners separated. Mr. Jewett bought out Mr. Root's interest and the firm of Sherman S. Jewett & Co. was organized. The two junior members, Henry C. Jewett and Josiah Jewett, were the sons of its founder. The remarkable success which rewarded the efforts of the firm in the past was continued under the new organization, and grew to the magnitude of the present. Up to the time of his last illness Mr. Jewett retained the same interest in its affairs as of old, and gave it the benefit of his ability and shrewd business foresight, which had laid the foundations of its success.

Mr. Jewett was President of the National Association of Stove Manufacturers for the years 1875, '76 and '77, and has hosts of friends and admirers in the stove business, all of whom will regret his passing away in the fulness of years and of honors.

Among the Foundries.

The Dickson Car Wheel Company, of Houston, Texas, are building an addition to their foundry.

The Enterprise Foundry Company, of Detroit, Mich., has filed articles of association. Capital stock, $5,000.

The Northington-Munger-Pratt Company, of Birmingham, Ala., intend to erect a foundry in the near future.

The erection of a machine shop and foundry is talked of at Poulan, Ga. J. G. McPhail is promoting the enterprise.

The plant of the Evilford & Northway Co., at Jordan, Minn., has been purchased and reopened by George & Cole, who will manufacture flouring mill machinery.

The Champion Iron Co., of Kenton, Ohio, will shortly erect several new buildings, necessitated by an increased business.

The Holland Radiator Company, of Chicago, is considering a proposition to establish a plant at Benton Harbor or St. Joseph.

The Standard Malleable Iron Works, of Muskegon, Mich., is said to be making plans and specifications for an extension of its plant to be added this spring.

Frank Kleckler has leased the Ross & Hastings foundry and machine shop on West Steuben street, Bath, N. Y., and will open it in the near future.

The Rippel Mfg. Co., of Mt. Gilead, Ohio, have secured a large contract, which will compel them to greatly increase the capacity of their foundry.

J. H. Tilden, of the Gurney-Tilden Foundry Company, Hamilton, Ont., has been re-elected president of the Canadian Iron Founders' Association.

The Excelsior Foundry Company has been incorporated at Peoria, Ill., with a capital stock of $5,000. Incorporators, John F. O'Brien, W. Cuthertson and George E. Beasley.

The foundry at Walden, N. Y., has started up under the firm name of the Rider & Ericsson Engine Company, a consolidation of the old firm and the Delamaters, of New York.

The Prince & Kinkel Iron Works of New York City has been incorporated with a capital of $25,000. Directors, K. N. Prince, Buckfield, Me.; Robert A. Kinkel and Julia F. Kinkel, Stapleton, S. I.

The Poplar Bluff (Mo.) Foundry and Machine Works has been purchased by Messrs. Breuer & Holcomb, late of Bloomington, Ill. The plant will be enlarged, new machinery added, and an effort made to secure the business of the surrounding section.

The Ohio Steel Co., of Youngstown, O., have commenced active operations towards the construction of its ten new open hearth furnaces. The plant is now running double time in all departments, with a good outlook for a still greater increase in business.

A. Weiskittel & Sons, of Baltimore, Md., manufacturers of stoves, have purchased a site of twenty-five acres, and will erect a new plant. New plant will include a large enameling establishment, iron foundry, etc. Gas and electricity will be used for lighting.

The J. W. Paxson Company, of Philadelphia, has been incorporated for the manufacture of foundry facings and foundry supplies. The capital is $450,000 and the directors are John W. Paxson, Josiah K. Bougher,

Howard Evans, Howard M. Bougher, Philadelphia; Alfred Platt, Burlington, N. J.

The Henry Roos Foundry Company has been incorporated at Chicago with a capital stock of $20,000, by Henry Roos, Matthias Hank and Louis Baumgartner.

The manufacture of radiators is to be added to the business of the Pierce, Butler & Pierce Manufacturing Company at Eastwood Heights, Syracuse, N. Y.

C. Hanika & Sons, architectural iron works, Muncie, Ind., are now building a foundry 50x75 feet, which will be ready for operation about the 1st of March, and are increasing their facilities throughout the entire works to meet the increasing demand for the "Hanika" fence and other architectural iron work.

In connection with the nickel works, that portion of the building which was used as a foundry for the manufacture of stoves and other casts will be run by a Pennsylvania ipany, now being formed. This company will begin operations on the first of July, and will manufacture stoves only. The works will continue under the name of the Troy Nickel Works.

Mr. John E. Gaitley, proprietor of the Troy Nickel Works, who recently purchased the Perry Stove Company's plant on Van Rensselaer Island, near Albany, N. Y., is removing his plant from Troy. He expects that the work will be completed by the middle of March, and that the plant will be in full working order by the first of May. The works will employ upwards of 250 men.

The Union Brass Co., of Bridgeport, Conn., with a capital stock of $300,000, and with F. J. Kingsbury, of Waterbury; W. H. Male and F. Kingsbury Curtis, of New York, as incorporators, is seeking incorporation before the Connecticut Legislature. The new concern is to acquire the plant of the Aluminum Brass & Bronze Co., and it is expected that work will soon be resumed at the factory.

An important addition to the manufacturing circles of Norfolk, Neb., has been made by the incorporation of the Norfolk Foundry and Manufacturing Company, for the purpose of manufacturing gasoline engines and hot air furnaces. Articles of incorporation have been filed, with E. A. Bullock, president and manager; C. E. Doughty, secretary; H. H. Patterson, treasurer; W. H. Bucholz and Burt Mapes as officers and incorporators. The present foundry property will be changed to meet the requirements of the business, and goods will soon be placed on the market.

The stone foundry building adjoining the stone building used as a machine shop and for other purposes, corner of Coffin avenue and Water street, New Bedford, Mass., which has been lying idle for some 20 years, is again to be occupied for the purpose for which it was erected. Edwin L. Besse, who for several years has been proprietor of the New Bedford machine shop, Charles Padelford, who for two years past has conducted the woodworking business in the same building, and Ferdinand S. Read, superintendent at the New Bedford Copper Works, have formed a co-partnership under the title of the New Bedford Foundry & Machine Co., with Mr. Read as agent, for the purpose of conducting a general foundry and machine business. The building is now undergoing repairs preparatory to running the new department.

Fire Fiend.

A small fire took place in the Acushnet Foundry, New Bedford, Mass., on Feb. 15. The loss is covered by insurance.

The Goelitz Brass Works, at Kokomo, Ind., was visited by fire recently, resulting in a loss of about $500.

A small blaze took place in the Bass Foundry at Ft. Wayne, Ind., on Feb. 11. Loss insignificant.

The foundry and machine shops at Osceola, Pa., owned by B. F. Stein, were burned to the ground by a recent fire.

Maher & Flockhart's extensive foundry, at 60 Polk street, Newark, N. J., was damaged by fire on Feb. 5. Loss, $7,500; no insurance.

On Feb. 5 the iron foundry plant of George Smith, 169 to 177 Second street, Jersey City, N. J., was burned, entailing a loss of about $20,000.

A fire in the pattern rooms of the Eagle Stove Foundry, at Fall River, Mass., on Feb. 11, damaged patterns and stock to the amount of $2,000. Insured.

The foundry building of the Link Belt Machinery Company, at Thirty-ninth and Stewart avenue, Chicago, was damaged to the extent of $25,000 by fire on Feb. 10.

Considerable damage was done to the patterns of the Coulter & McKenzie Machine Tool Co., at Bridgeport, Conn., by a fire on Feb. 1. The loss is covered by insurance.

The foundry and machine shops operated by Coombe & Carthew, at Lambertville, N. J., caught fire on Feb. 17, and the main building containing valuable machinery and patterns was gutted. The loss is about $6,000, with no insurance.

A fire broke out somewhere in the neighborhood of the core ovens of the Standard Foundry Company's plant on Collins and Dickson streets, St. Louis, Mo., on Feb. 13, and before it was extinguished did about $15,000 damage to the building and contents. Considerable of the loss sustained was on patterns, quite a number of which were destroyed. The company will begin the work of rebuilding the moment the insurance is satisfactorily adjusted.

The McMinnville Foundry & Machine Works at McMinnville, Tenn., owned by Thomas H. Eastwood, were destroyed by fire on Feb. 3. Nearly all the machinery and patterns were saved; also, the warehouses and their contents, which stood near the foundry. Mr. Eastwood had been casting in the afternoon, and it is supposed the fire originated from that, as it was first discovered in the foundry. It will be rebuilt at once. The loss is estimated at $6,000, with an insurance of $3,500.

Pittsburg Report.

The last week or so of February was an eventful one in the history of the iron and steel trade, and will be long remembered by merchants. The steel rail situation remains the most interesting feature of the market. The estimated amount of sales is placed at 1,100,000 tons, and the money invested reaches the enormous sum of $20,000,000. This flurry has had at least one result; that is, a better feeling throughout the trade. While this improved tone is not shown in higher prices, it is certain that the outlook is considerably better than it has been since the winter set in.

There is a large amount of work to be turned out for use during the coming season, consequently the rail concerns west of the Alleghenies are pretty well sold up. In this district there have been large sales of Bessemer pig at advancing prices, the minimum being $10 75. Prices of nearly all products, except Bessemer pig and billets, are still on the low level of several weeks past. Cheap raw materials in 1897 may prolong the present level or something near it. Some sellers of foundry irons have had larger inquiries during the past week or so than for some months.

The market may be called steady, but there are no distinguishing features either in the way of strength or weakness. The volume of business is increasing, the aggregate amount of sales for February being more than double the amount recorded during January, but this large increase has not stimulated prices. No. 1 foundry is selling at $11 25@$11 50, and No. 2 foundry at $10 75 @$11 00. Nearly all the foundries in operation have greatly increased their output, and several have put on slightly increased forces of men. Stocks of foundry irons are quite heavy.

The coke trade is very active, the shipments having increased lately at a wonderful rate. For the week ending February 25 the shipments by cars aggregated 6,600 cars, or an increase of 521 cars over the previous week. The average working time is about five days a week. The circular prices of coke are as follows: Furnace coke, $2 00; foundry coke, $2 25; crushed, $2 25; all per ton of 2,000 lbs., f. o. b., on cars at ovens.

The Kepp Gear Wheel and Foundry Company's works in Allegheny were recently destroyed by fire, thought to be of incendiary origin. The foundry was a two-story brick structure, and there was an immense number of wheels and much machinery in it prior to the fire. Almost everything in it was destroyed, and it is estimated that the loss will be at least $30,000. The company manufactured a patent gear wheel, besides motor car wheels. A large order had just been completed and the prospects for work all next summer were good.

Chimmie Powers in St. Louis.

Anything new around town, Jimmie? Where did it happen, what is it, and is it interesting?

Hully-gee, but you don't want to know much, do you? But say, Cully, you got to blow yerself to hear frum me, an' it will cost you ten cents a blow. I jus' got in frum a ball, er a "rag," an' I been geesed up all nite, an' I need a little of de hair of de dog. What will I have? Now yer talkin'. Well, I don't want a glass o' peanuts, so gimme a skee. Yes, I was out at de coremakers' ball, an' dere wus a putty smooth crowd dere. Joe Carlin wus de "hole ting," an', say, you ought to see him wid de claw hammer coat; but "Kid Pendergast" didn't show up, an' I never heard why, but mos' of the ol' timers in town wus dere as usual, an' dey wus to quiet fur me. Dem fellers runs a ball like a Sundy skule picnic. Dey never have a skrap, so I pulled mi freight early in de game, an' went down to Druid, where de tobacco workers had a recept'on, an', say, dere's where de Mames an' Mags wus, an' dere wus notin' but a good time. Every one wus full of joy an' booze, an' a fight every few minits. Is times getting any better in St. L., and is it true that pig iron has advanced in prices? Say, what de hell's eatin' you. I never bot any pig iron in mi life, an' I don't know what de price of it is, but times ain't gettin' an' better, dat's ded sure. Duetrows is doin' putty fair. I wus lookin' in dere las' week one day, an' I seen Paddy Kain, Pat Leonard, Brockman, Wanhoff an' de hole gang of gradates frum Jerre Allen's academy, includin' McKillops. He quit de whisky bisnes an' went back to work, sayin' dat no 'onest man could deal in liker. Rankin and Fritch shut up shop fer keeps, an' der tryin' to sell out.

Andy Gilsinn, dat wus foreman of de Phoenix, died a short time ago, an' dey say he died from a broke heart, 'cause he sunk de earnings of a lifetime in date shop, den it failed an' left him broke, but he always got de pound of flesh out of de men al right 'nuff. Pete Brennan, Tim McGrat an' Tom McGovern, three ole timers, died to, but there ain't any one quarlin about der estate. Little Ed Fitzgerald retired from de sand arena altogather, an' went to de solgers' home in Kansas. I met ole Briney McGill lately, an', say, he is completely broke down. Bryan is an' alway was a good feller, an' never done any one harm but himself. Anoder ole broken-down sport I met was Johnnie Doddy, an', say, he wus a "reck out of site;" time wus when he wus de "leadin' man" in Allen's, but it's de same ole story over agin. He wus tellin' me dat ole Jock Johnson is livin' yet, an' dat reminds me of ole Jock workin' under a ten-foot cope at Allen's several years ago, an' about 9 o'clock he went out after his pigs' milk (his whisky), an' when he come back de big cope wus dumped on de floor, de blockin' give 'way an' it fell. After dat Sam Wilson an' some more of de gang started drinkin' agin, an' dat 'minds me of de only time Jim McKillops swore off. He got one of his "breadwinners" cought in the cogs of a crane a' Deutrows.

Say, you know de racket iron makes when it gets aginst a bar, don't you? Well, you ought to hear Tom Buckley when he gets aginst one, an' gets 'bout four skees in him. To hear him tell it dere ain't many molders in St. Louis dat knows how to lite de gas on de work he makes, an' if you laf at him he will tell you it's no barrell house talk either, but I alway jolly him an' say he's a cracker-jack. I see de flamegater workin' at de St. L. Car Wheel Works, an' I hear dat he served his time drivin' a street car past a foundry in Louisville, but Flammy is al-right frum de hat up, even if he did serve his time in a collar-button foundry.

I see Charley Stanton, of Pittsburg, Pa., was here at his old home lately. When Charley was a sub in de ole Vulcan core room under Paddy Coleman he use to tell about every time Paddy had a particular core to make, he would send him away after a wheelbarrow full of brick. Charley was misfortunate 'cause when he went on de floor he had an eye burnt out, but 'taint no wonder dat all de cubs in dat shop turned out to be good waltzers. Dere wus six of dem workin' in de dog-shop mos' of de time. One of dem use to watch fer de ole man, another played de mout music, an' de rest waltzed, but dat gang's all scattered now. J. Crane is in Texas, Lou Tilley's in Jersey, Mike Welsh and Jim McGrath are here in town. Billey Coogan's on de pleece force, an' Jim Robinson's on de bum.

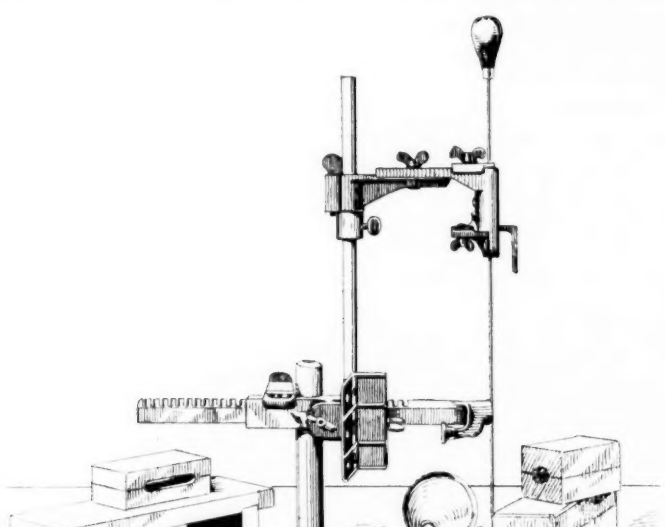
Say, Pettke, you know what I took las' time, don't you? Well, repete de dose, den I mus' chase myself, 'cause I'v got a date fer dis evenin', goin' to take mi dame to see Corbet at de teater.

The Adrians Core Making Machine.

While a few mechanical appliances have been brought out to help the core-maker in producing more accurate work, the general application of such has been confined to places where a great number of a certain variety of cores has been demanded. We illustrate herewith a machine that can be adapted to nearly all the cores now made in split boxes. It is claimed that the most difficult cores may with it be produced with absolute exactness and at a rapid rate of speed.

The machine consists of an upright standard, which can be bolted to the core bench or any other object at hand and can be put on or removed at pleasure with the loss of but a moment's time. To this standard is attached the carriage through which the clamp bar, having rack on top, passes. The head of clamp is self-adjusting. The carriage can be adjusted for different length of cores. To the carriage is fastened one of the jaws, to which is attached a right-angle face plate, adjustable to any position, allowing a core-box of any shape to be held in such a manner as to have center of core in perfect line with vent-rod and also permitting rods intended to strengthen the core to be placed in any desirable part of the core.

The face plate may be removed for very short cores. The adjustment of the jaws may be effected instantly, so that a change from one kind of core box to another is accomplished without loss of time. It may be added that this machine has been brought out by a practical foundryman, and has been sufficiently tested to show its merits. Lyne Adrians, of Grand Rapids, Mich., is the inventor.



THE ADRIANS CORE MAKING MACHINE.

Thos. D. West's New Book.

The author of "Metallurgy of Cast Iron" is so familiar to our readers that anything in the way of an introduction is entirely superfluous. In this volume Mr. West has gone a step beyond his former writings on foundry practice, and treats a higher and more important subject. It is true that both "American Foundry Practice" and "Molders' Text Book" contain much useful information

on the properties of cast iron, but from the fact that these works deal mainly with examples of molding the question of metallurgy has largely been subordinated to other interests.

"Metallurgy of Cast Iron" has the distinction of being written by a practical foundryman, and is worded in such a manner as not to befuddle the reader with terms which he is unable to understand. The value of a book does not lie so much in how much is said as in how well it is said. Mr. West has shown his ability to make himself understood in previous works, and his new book has evidently been edited with the same object in view.

The 575 pages comprising this volume, are divided into four parts. In the first is illustrated how coke is produced and what causes some of the defects often complained of by foundrymen. Passing from the manufacture of coke, the elements in iron ore are explained and reasons given why iron made from certain ores is superior to that made from others, in different lines of foundry work. The next chapters are taken up with a series of articles on "Furnace vs. Cupola Practice," in which the author contrasts some of the differences found and offers many suggestions of a practical nature to the foundryman.

Part II takes up cupola construction, and reviews what has been accomplished with the center blast up to date. Mr. West has been a central figure in connection with this innovation in melting, and much of what he says has been learned by individual experience. In addition to the improvements Mr. West has devised for a better application of the method, there are also illustrated the different types of cupolas using a similar system of center tuyeres. This part closes with a description of natural and suction draft cupolas, to which the author supplies such information as experience has shown to warrant. "Contracted vs. Round Cupolas" for long heats forms a chapter which may be read with advantage by all who are, or expect sometime to become, identified with the melting of iron.

The science of mixing and melting iron occupies Part III. Much of the matter here presented is partially known to the studious foundryman, having formed part of papers contributed by the author and read before the several foundrymen's associations. The author has treated this part in a comprehensive manner, and much help is offered the foundryman to intelligently produce satisfactory mixtures.

Mr. West's ideas in regard to the testing of iron, forming Part IV, are largely known. In the 172 pages devoted to this subject are to be found many reasons in favor of the system which the author advocates as the best method of obtaining reliable tests.

It will be recollected by many that his first book ("American Foundry Practice") contains one hundred items for apprentices, which have also been largely used by others. The present volume contains one hundred items that everybody should know, giving in a condensed form much information about which pages might be written.

The work contains 106 illustrations and 79 tables, many of the latter forming part of articles on different subjects.

Taking it altogether Mr. West has contributed greatly to the progress of foundrymen, and his last work, being in advance of his previous efforts, will undoubtedly be received with favor by those interested in the mixing, melting and testing of iron, which, by the way, should include every one connected with a foundry who intends to advance himself to the highest place that the trade affords.

No one can write as extensively as Mr. West has done without being subject to criticism, though such as has fallen to him has merely tended to show that he had awakened in his fellow-craftsmen a tendency to study questions of vital importance to them, and criticism of this kind indicates that his labors have been appreciated.

The book may be obtained of The Foundry Publishing Co., Detroit, Mich. Price, $3.

The Art Stove Company, of Detroit, Mich., have issued a supplemental catalogue describing some of the many artistic points to be found in their stoves.

Gould & Eberhardt, of Newark, N. J., have just issued a neat catalogue of their various models of shapers. Those interested in this branch of machinery should not fail to obtain a copy.

NOTICE!

Advertisements in this column, 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than the 1st of the month to insure publication.

Answers addressed to our care will be forwarded.

TO SUBSCRIBERS

whose names appear on our **subscription** list, we will give one free insertion under this heading to those in want of positions, the advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

FOR SALE—A foundry and machine shop in Northern Indiana at a bargain. For further particulars, address F. WM. DORN, Huntington, Ind.

WANTED—To buy small foundry and machine shop; Southern Michigan or Northern Indiana preferred. Address Box 60, care THE FOUNDRY.

FOR SALE—No. 3 Root blower, used only few months; to be replaced with largest size. Address Box 4, care THE FOUNDRY PUBLISHING CO.

WANTED—Situation as foreman in iron or brass foundry; 19 years' experience. For the past nine years connected with marine works. Address Box 63, care "THE FOUNDRY."

WANTED—Position as bench foreman in a Snap Shop, or will assist floor foreman on the bench. Eighteen years' experience on light and heavy bench work. Address Box 61, care THE FOUNDRY.

SITUATION WANTED—As foundry foreman by a young man, a thorough mechanic, intelligent and of good moral habits; one who understands his business; can furnish reference. Address Box 62, care THE FOUNDRY.

FOR SALE—Right to use "Thomson Patent Reader" for pipe patterns. Description appeared in February number of FOUNDRY, page 261. Apply to James Thomson, Gartshore-Thomson Pipe & Foundry Co., Hamilton, Canada.

SITUATION WANTED—By a thoroughly competent man, both as mechanic and manager, to assume charge of foundry plant, proficient in economical production. Has experience. Can furnish reference. Address Box 58, care THE FOUNDRY.

WANTED—Situation as superintendent or foreman of foundry. Am able to furnish estimates and produce satisfactory iron mixtures. Fifteen years' experience as superintendent and foreman. Best of references. Address Box 43, THE FOUNDRY.

WANTED—A position with a western foundry company as assistant superintendent or salesman, by one who understands the construction of stoves, furnaces, ranges and steam and hot water heating apparatus and all the details of management of foundry making the above goods. Address Box 59, care THE FOUNDRY.

WANTED—Position as foreman of pattern shop by a young man with seven years' experience in a general job foundry where architectural work is a specialty. Thoroughly understands plans of all descriptions, also best methods of molding heavy columns. Could manage foundry as well as pattern shop if required. Address Box 65, care THE FOUNDRY.

LIVE FOUNDRYMEN, ATTENTION! I want to make a change if I can find the right party. Competent to fill any position in foundry life and have the experience; you needn't pay for experiments. Best reference. Life is too short to waste, hence only those really wanting a man of energy to conduct their business, please address Box 27, care THE FOUNDRY.

POSITION WANTED—As manager or foreman in malleable iron foundry by a man of middle age; twenty years' experience around furnaces as melter and annealer. Can handle men to the best advantage, and am able to produce high-grade iron at a low cost. Can furnish A1 references from last employer in regard to ability and character. Address Box 57, care THE FOUNDRY.

FOR SALE—The Carterville Foundry and Machine Works, of Carterville, Mo. The plant is doing a business of from six to ten thousand dollars monthly. An extensive trade has been established in all kinds of mining machinery and a high reputation built up for the efficiency of the Carterville Crusher and Centrifugal pump. The entire plant will be disposed of at a low figure.

FOR SALE—A complete set of iron patterns for one of the most modern constructed corrugated warm air furnaces on the market, including three sizes. Also a first-class set of register patterns. Furnace has been on the market five years and has good established trade which goes with patterns. Price reasonable. Reasons for selling, other business demands our capital and attention. Address Box 48, THE FOUNDRY.